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The following selections from Soviet media on the aftermath of the Chernobyl Nuclear Power Plant accident and the mobilization of labor and technology in the clean-up effort will be published in the series USSR REPORT: POLITICAL AND SOCIOLOGICAL AFFAIRS under the subtitle AFTERMATH OF CHERNOBYL NUCLEAR POWER PLANT ACCIDENT. This is a representative list of the items selected for that report.

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OIL AND GAS

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IMPROVED DEVELOPMENT OF GAS-OIL POOLS OUTLINED

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 4, Apr 86 pp 27-31

[Article by V. M. Yudin, V. Ye. Leshchenko, V. Ye. Gavura (Minnefteprom [Ministry of the Petroleum Industry]), M. L. Surguchev, V. V. Isaychev (VNII [All-Union Scientific Research Institute of Petroleum and Gas]), and A. K. Kurbanov (MING [not further identified]): "Tasks of Improving the Efficiency of Oil-Gas Pools"]

[Text] In recent years the raw-material base of the petroleum industry has changed considerably. An ever-growing proportion of oil output belongs to oil from complexly structured pools, including gas-oil pools, in which the oil reserves are often contained in extensive and low-producing sub-gas zones. During the 12th Five-Year Plan, among the new wells being put into production, a significant proportion are gas-oil, gas-condensate, and gas-and-oil-condensate wells.

More than 400 gas-oil (GNZ) and gas-oil-condensate (GNKZ) pools have been tapped at 200 fields in the USSR, including the Western Siberian fields of Samotlor, Varyegan, Lyantor, Bystrin, and others.

The GNZs developed vary widely in the conditions of oil and gas occurrence, the relative volumes of pore space, oil and gas saturation, the collector properties of the productive deposits, and the depths of their occurrence. The productive formations in the majority of them are terrigenous rock, mainly sandstone of various properties.

In most cases the GNZs occur at a depth of 1000-2000 m, and contain comparatively small oil reserves. The conditions of the occurrence of oil and gas, and the nature of distribution of the reserves by zones are of great importance for rational development.

Proceeding from this fact, there are several classifications (Footnote 1) (A. V. Afanasyeva and L. A. Zinovyeva, Experience of Developing Gas-Oil Pools, Moscow, Nedra, 1980), which reflect the conditions for the fillup of a trap with gas, oil, or water, the correlation of the gas- and oil-saturation volumes of a pool, and degree of activity of the area beyond the outline. All these classifications divide the main types of pools and then subdivide them according to the correlation of the pore spaces filled with oil and free gas.

The most difficult task is to recover oil from oil fringes that are shallow and have an extensive sub-gas zone. In most oil and gas producing areas GNZs are confined to multi-formation fields in which the productive layer contains pools of various types -- oil, gas, and gas-oil. These pools are generally divided into independent productive formations, because of the difficulty of uniting them into a single formation.

More than 70 percent of GNZs have been operating for 20-30 years or more. Many of them are at the final stage of development. In certain areas GNZ development provides the major share of total oil output.

The heterogeneity of GNZs and the presence in them of oil and gas reserves not separated from each other determines the specifics of developing them when compared to purely oil fields. There are 13 systems of developing GNZs in actual use. Many of them, except for processes involving the pumping of gas, have been adopted on various scales or tried out in fields of the Soviet Union. Many years of experience have shown that at a GNZ it is difficult to maintain the same system from the first to the last years of development. A large part of the GNZs in the older areas were developed without maintaining pressure by utilizing the natural energy of the formation system and the gas of the gas cap, while restricting the role of the dissolved gas. The effectiveness of this kind of development depends on the geological-physical properties of the collectors, the conditions of the occurrence of oil and gas, the correlation of the volumes occupied by these fluids, the activity of the waters of the areas beyond the outline, and the rates of oil withdrawal.

There are examples of the successful development of GNZs without maintaining formation pressure in Volgograd Oblast, in Uzbekistan, and in other areas. In Turkmenia GNZs and GNKZs have been operating under this system for a long time.

Small sheet pools with narrow oil fringes and massive pools with little thickness of the oil layer are the most difficult to develop. These are typical of areas in the Saratov Volga region, the Ukraine, and Western Siberia. Typical of the Saratov Volga region are multiple formations, small-size pools, and the occurrence of oil in the form of narrow fringes of commercial and non-commercial value. During operation a rapid and sharp decline of oil output was noted because of an increase in gas factors and water encroachment, the intensity of which depends on the connection between the pools and the drainage from the area beyond the outline. One row, or rarely two rows, of producing wells are usually located within the limits of narrow fringes.

The limited well stock reduces the effectiveness of regulating measures. The total extraction of oil is therefore often at a low level.

In the Ukraine, besides the difficulties mentioned of developing wells with narrow oil fringes in multi-formation fields there is an additional problem of the great depth at which the productive deposits occur (3500-5000 m). The narrowness of the oil fringes (100-600 m) reduces the effectiveness of drilling exploratory and producing wells.

Theoretical research and field practice have demonstrated that, when developing without maintaining pressure under formation conditions where the oil zone and the gas cap are not segregated, the regulated withdrawal of gas from the gas cap is of special importance for the complete extraction of the oil. If only oil is extracted, pressure in the oil zone drops, thus causing an expansion of the gas cap. The intensity of gas penetration into the oil zone depends on the the rate of oil withdrawal, the correlation of the gas- and oil-saturated volumes, the properties of the collectors, and the activity of the waters of the area beyond the outline.

Gas breakthrough generally complicates the operating process and reduces its effectiveness. To improve the oil output of GNZs and ensure the optimum rates of oil withdrawal, various modifications of flooding are employed in the Soviet Union's fields. The first studies on flooding a GNZ started in 1955 at the Bakhmetyevskoye field (the B_1 formation), when the pool was just starting to be developed. At the first stage flooding was instituted beyond the outline, which in 1960 was completed as a barrier.

Many years of operation of a large number of GNZs with various characteristics have enabled us to amass much experience of designing development systems without maintaining pressure and with flooding of various modifications.

Flooding has been employed at such fields as Sangachaly-more, Kotur-Tepe, Barsa-Gelmes, Korobkovskoye, Zhetybay, and others.

Positive results have been obtained in developing GNZs in fields with high permeability (up to 1-2 mkm^2), with relatively homogeneous collectors, low oil viscosity (1-2 mPa X s), and an active drive system. High indicators have been achieved at the Anastasiyevsko-Troitskoye (Stratum IV) and Bakhmetyevskoye fields. At the Anastasiyevsko-Troitskoye field methods were successfully worked out of developing oil reserves from sub-gas zones with an active natural hydraulic head system.

At small GNZs with small reserves and low productivity, being developed by depletion systems, the oil-output ratio usually does not exceed 0.2.

In recent years in GNZs in Western Siberia at the Samotlor, Varyegan, Lyantor, Fedorovo, Bystrin, Yaun Lor, Vyngapur, Tarasovskoye, and other fields experimental-industrial operation has been applied, because, unlike most GNZs being developed, these pools have extensive zones with a rather narrow formation, low permeability, a high degree of irregularity of the collectors, and a complex geological structure.

It was completely impossible to employ here the existing experience of developing GNZs. New technological solutions, methods, and systems of development were required.

In this connection Minnefteprom has approved a program of studies that encompasses virtually all problems of developing GNZs. Involved in carrying it out are specialists from the industry's institutes, VUZes, and industrial

associations.

The industry's scientific research institutes have carried out theoretical and experimental studies, on the basis of which they have developed a method of predicting the technological indicators of developing GNZs, set up mathematical models of multi-phase filtration which have made it possible to determine the effect of formation irregularities on permeability and thickness, the physical properties of the fluids, the dynamics of bringing in and shutting down producing and injection wells, measurements of their operating conditions, changes in the system of development, and other matters. With the aid of these models studies have been made of the mechanism of the process of displacing oil and gas by water under various geological-physical conditions. At the present time they are the only means of estimating the effectiveness of various methods and systems of developing GNZs and GNKZs.

A system of barrier flooding, appropriate for these conditions, has been created, which makes it possible to ensure more effective development of the sub-gas parts of pools. Of special importance in problem-solving are experimental-industrial studies aimed at determining the feasibility of intensifying the withdrawal of oil from extensive low-productivity sub-gas zones by flooding, and the development of methods of monitoring and regulating the process, techniques, and technology of oil extraction. Since 1976 various modifications have been studied of development systems employing barrier flooding. New technological solutions of barrier flooding are being employed for the first time at the AV_{2-3} pools of the Samotlor field. Prior to the bringing in of pumped barrier wells, an increase had been noted here of gas factors in the producing wells and in the sub-gas and oil zones. Results from studying the wells have shown that this occurrence in the wells of the oil zone is caused by an expansion of the gas cap. In monolithic zones gas breakthroughs have been observed, with depressions that exceed maximum permissible values. The gas content of oil extracted has grown to 4000 m^3/t and more, and the well output of oil has sharply declined.

With the introduction of barrier rows of injection wells, the gas in the operating zone must be withdrawn through the oil wells, and therefore an increase of gas factors in the initial period of introducing barrier flooding and high values for them at a certain stage of operation are inevitable and are in line with the development technology. The amounts of technologically required gas withdrawals are defined in the operating documents.

The transformation of sub-gas zones into oil zones at the AV_{2-3} formation increased the number of wells containing gas. This has been noted even for wells of a purely oil zone. Systems of barrier flooding have now been almost completely introduced. Because of the introduction of this new technology in 1982-1984 1.8 million additional tons of oil have been extracted from this formation.

The Varyegan gas-oil field is among the most difficult in Western Siberia. The column of this multi-formation field is represented by almost all known types of oil fringes. Barrier flooding has been applied to its highly productive formations. Unlike the normal case, the pools are further divided into

three-row units. Barrier flooding has been virtually accomplished here. In the central part of the BV_6 and BV_8 formations, and in all of the BV_7 formation, a pumped-water barrier has been created. Elevated gas factors have been observed in the wells of the central part of the pools. After the water barriers have been created in the formation, the segregated gas is drawn off through the oil wells of this zone, in conformity with the design technology.

Area systems of flooding are being applied at other gas-oil formations of the Varyegan field. The accomplishment of this, however, is at the initial stage.

Experimental-industrial studies are also going on at the Lyantor field to test the area system of flooding in a pattern measuring 400 X 400 meters. The AS_9, AS_{10}, and AS_{11} formations of this field contain GNZs of the water-oil type, which generally have extensive sub-gas zones. The most intensively explored Lyantor area has been selected as the priority sector for development.

The industrial experiment on flooding carried out here has been aimed at determining the feasibility of intensifying inflow and refining the mechanism of the process of flooding a sub-gas zone and displacing oil, gas, and bottom water by the effect of pumped water in depressions that exceed permissible limits for those without gas or water.

Analysis of the results of developing the experimental sector has shown that the nine-point area system employed ensures a high rate of oil withdrawal. At the Lyantor field the studies are at an early stage, and final conclusions regarding the mechanism of the process and its effectiveness will be possible only after collating the research data.

The theoretical and field research done in Western Siberia and other areas have demonstrated the feasibility of intensifying oil withdrawal from sub-gas zones and of increasing the effectiveness of developing them.

High rates have been achieved, comparable to the rates for purely oil zones, of developing the reserves of sub-gas zones; the introduction of oil into the gas cap, which increases irretrievable losses of it, has been prevented; and expansion of the gas cap and gas contamination of producing wells have not been allowed.

There are, however, factors that seriously hamper the development of GNZs. The design stages are not always supplied with reliable initial information on the formation, and technological solutions are sometimes based on inadequate geological-physical models of the pools. Studies are being poorly developed that relate to the elaboration of gas-hydrodynamic methods of exploring the formations and wells of GNZs.

Too little attention is being paid to the theoretical study and mathematical modelling of the development processes of GNZs and GNKZs in carbonate collectors. The problems of improving the quality of formation exposing and of preparing water for flooding, which are of special importance for low-producing collectors, have not been fully solved. Instances have been noted of

poor-quality well casing, which, under the conditions of sub-gas zones, causes premature gas and water breakthrough and reduces the efficiency of development.

There are no reliable means or methods of determining the position of a GNK after completion of well drilling. The problem of determining the saturation of gas caps and the advance of it has not been solved. This makes it difficult to reach well-founded technological solutions when developing sub-gas zones.

The experience accumulated enables us to formulate the main problems and requirements for the development, monitoring, and operation of gas-oil pools as follows:

integrated solutions for extracting oil from a sub-gas zone and the gas from the gas cap;

more careful preparation of fields prior to development, and the necessity for preliminary experimental-industrial studies;

keeping the position of gas-oil contact constant in order to prevent loss of oil escaping into the gas cap;

not allowing the formation of gas or water cones in producing wells, or of gas fingers when gas breaks through from gas caps into producing wells;

further development of studies on actively developing extensive sub-gas zones with poorly saturated layers of oil, low permeability, and great irregularity of the collector;

simultaneous solution of problems related to the techniques of extracting oil with a high water cut and the transportation of a gas-contaminated liquid;

close monitoring of changes in gas factor and of advance of gas-oil contact and gas-oil-water saturation in the columns of producing and injection wells;

extensive use in scientific research on the development of GNZs and GNKZs of the methods of mathematical modelling of the three-dimensional, three-phase filtration of gas, oil, and water.

OIL AND GAS

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VOLGOGRAD GAS-OIL POOL DEVELOPMENT DESCRIBED

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 4, Apr 86 pp 31-36

[Article by K. P. Asimov and S. Ya. Chernyy (both of Nizhnevolzhskneft [not further identified]), and I. A. Yakunin and A. A. Zagoruyko (both of VolgogradNIPIneft [Volgograd Scientific Research Institute of the Petroleum Industry]): "Effectiveness of Developing the Gas-Oil Pools of Volgograd Oblast"]

[Text] Rational systems of developing gas-oil pools are based on the utilization of the natural energy of the gas of the gas cap. They are divided into the following systems: employing a process of expanding the gas cap; maintaining immobile gas-oil contact (GNK) by regulating the formation pressure in the pool and drawing off gas in the appropriate amount; partial or complete gas blowoff, causing the entry of oil into the originally gas-saturated part; and artificial stimulation of the pool (barrier and within-contour injection of a displacing agent).

All the above-enumerated development systems have been employed in the pools of the Lower Volga in connection with the search for ways of developing reserves that will ensure the least complicated well operating conditions, acceptable development rates, and a high ultimate oil yield under the various physico-geological conditions of the occurrence of gas and oil.

The systems were designed in 1950-1960, part of them were being suggested for the first time, and were generally being introduced on an experimental basis. For example, development by keeping the GNK immobile was first designed in the USSR by VNII [All-Union Scientific Research Institute of Petroleum and Gas] in 1955 for the B_1 formation of the Bakhmetyevskiy area, and in 1956 for the Bobrikovskiy stratum of the Korobkovskoye field. The immobility of the GNK in the first case ensured the maintenance of formation pressure and of well operating conditions, and in the second -- the withdrawal of gas from the gas cap in an amount to match the decline in formation pressure. The system with complete gas blowoff was designed in 1963 by VolgogradNIPIneft for the Bobrikovskiy stratum of the Bekhmetyevskiy [sic] area. Then similar systems were designed for other pools of the Lower Volga. At about the same time the institute established the necessity of barrier flooding at the pool of the B_1 formation of the Bakhmetyevskiy area. In 1976 VolgogradNIPIneft also developed measures to improve the development of the gas-oil pool of the Bobrikovskiy stratum of the Korobkovskoye field.

This article reviews the effectiveness of the most representative systems of developing the pools of the A_2 and B_1 of the Bobrikovskiy and Yevlanovsko-Livenskiy strata of the Bakhmetyevsko-Zhirnovskoye field, and also fo the Melekesskiy and Bobrikovskiy strata of the Korobkovskoye field. The geological-field properties and the utilization of the development systems of the first five formations have been adequately dealt with in the literature, but for the sixth formation the results of improved development were obtained in 1983-1984, and we will therefore deal with them in more detail.

The gas-oil pool of the Bobrikovskiy stratum of the Korobkovskoye field is confined to an assymetric brachyanticlinal fold with a box-type roof, with a steeper (3-4°) southeast termination, and a gently-sloping (about 1.5°) north west termination. The stratum occurs on the average at a depth of 1800 m, and consists of sandstone, aleurolites, and clays.

In section the productive part is divided into from one to seven sandstone bands. In the western limb and the southern pericline the sandstone is monolithic, while in the roof of the structure and in the eastern and northern parts the stratum is fragmented with bands of clays and argillites into bands of sand, but the fragmentation of the formation does not disrupt the single hydrodynamic system. In certain sectors of small dimension there are zones of difficult hydrodynamic linkage and cul-de-sac zones (the western and northern zones of the structure).

The pool is stratal and anticlinal. The initial position of water-oil contact (VNK) was established at the absolute mark of 1543 m, and the GNK at 1492 m. The layer of gas presence was 25 m, and of oil presence 51 m. Permeability, determined by drill-hole survey, was 0.445 mkm^2, and the viscosity of formation oil was 0.55 mPa X s, and of formation water 0.75 mPa X s. Initial formation pressure was 17.9 MPa, and the gas saturation pressure of the oil roughly matched formation pressure at a formation temperature of 59°C. Under initial conditions the viscosity of the gas of the gas cap was 0.02 mPa X s. Piezoconductivity of the formation exceeded 32,000 cm^2/s.

The greater part of the initial oil reserves were contained in the oil zone, followed by the sub-gas and water-oil zones. The main reserves of the gas of the gas cap were concentrated in the gas-oil zone.

The pool was discovered in 1951. Exploratory operations were carried out from 1955-1957, and from the resulting data VNII drew up a development project. Development of the oil reserves was provided by the natural energy of the elastic water and gas head by reducing formation pressure below saturation pressure. It was proposed to keep the GNK immobile by blowing off gas from the gas cap. Two operating rows of wells were sited in the purely oil zone, and one in the sub-gas zone. It was intended to operate two rows, and the third was planned to set up a cut-off field for the outer row. Four observation wells were recommended to monitor the position of the GNK, and would also be used to withdraw gas from the gas cap.

Development drilling showed the absolute mark of the GNK four meters higher

than had been supposed earlier. The area of oil presence increased accordingly, and the necessity arose of drilling a fourth row of producing wells, which was brought in after cutting off the wells of the first row. By 1963 the drilling stage was complete.

The pool was developed with three rows of wells. The design withdrawal of oil was reached in 1961. Gas was not drawn from the gas cap, and the GNK therefore sank and the wells were contaminated with gas. The first proposal on the need to pump water into the GNK zone to prevent expansion of the gas cap and increase the oil output of the sub-gas zone was made in 1963, but it was turned down, and the pool continued to be developed by the authorized system. In 1967, in order to improve the final oil yield of the Bobrikovskiy stratum and improve well operation, especially in the sub-gas zone, VolgogradNIPIneft recommended a development alternative that employed within-contour and barrier flooding. However, this recommendation was not accepted either.

The necessity of increasing withdrawals from the formation compelled that the oil reserves in the entire sub-gas zone be brought into development. The number of rows of producing wells was therefore increased to five, and gas started to be withdrawn from the gas cap. Since 1971 oil and gas yield has increased by a factor of 1.7, thus increasing the rate of decline in formation pressure, which in turn reduced the period of flow production from the wells and made it difficult to maintain the attained level of oil yield. By increasing the density of the well pattern by drilling the additional row and the recovery from the lower-lying formation, the decline in oil yield was noticeably slowed in 1974, but only for a short period. By 1976 the pressure in the withdrawal zone had decreased to 9.9 MPa (by 45 percent relative to the initial pressure). Of the wells formerly in operation, 31 percent were abandoned, 27 percent of them because of complete water encroachment. More than 1/4 of the existing stock was being operated by the intensified-pumping method, which under the conditions given was of low productivity.

Rapid flooding of the wells of the outer row, low formation pressure, and low productivity of the SShN [well sucker-rod pumps] caused a considerable fall in the rate of output. The necessity therefore arose of substantially altering the system of developing the pool.

Measures to improve the system of development, which were worked out by VolgogradNIPIneft, began to be carried out in 1977. By that time the pool was at the third stage of development. Considerable changes had occurred in the distribution of the reserves of oil and gas in the area. The current reserves of oil in the non-flooded part seemed to be concentrated in the residual zone, the initially oil-saturated zone, the zone filled with oil in the process of development, and the gas-contaminated zone. Moreover, in the initially oil-saturated volume a considerable part of the oil reserves were in the current water-oil, gas-water-oil, and sub-gas zones, and the remaining reserves were concentrated in the sub-gas and the oil zones. The residual reserves of gas were mainly contained in the initially gas-saturated volume in the gas-oil zone. The difficulty of keeping the GNK immobile caused it to move closer to the center of the pool in the west and south of the structure, and in the north to shift down along the formation dip.

Measures to improve the system of developing with later slight adjustments have included: flooding beyond the contour through 15 water-encroached wells of the first row; within-contour flooding through 11 periodically operating wells of the inner rows; gas-lift recovery from the highest-yield wells with a water cut of 70-85 percent, and where the water cut is higher -- shifting to operation with well sucker-rod pumps. Used for the flooding was the formation water of the Lower Permian deposits in this field from special wells equipped with UETsN-16 [centrifugal electrical pumps]. The injection water was to be provided by these facilities. Pumping volumes were determined in the light of actual losses in the zone beyond the contour, and in the first years the volume of pumped water compensated for withdrawals and the restoration of the formation pressure to 13 MPa, but in later years -- just for the withdrawals. In the first years it was intended to accomplish gas-lift recovery by a noncompressor method by utilizing as the working agent the high head of gas in the gas cap, which which enabled this method to be rapidly achieved.

It was planned to extract the oil between the injection lines by the existing wells, including the gas and control wells, and in the roof part of the pool -- by newly drilled wells after the appearance in them of oil evenly distributed by area. It was proposed to extract from these wells the reserves of gas from the gas cap in the central part of the pool. The intention was to extract the gas of the gas cap from the outer part of the gas-oil zone together with the oil.

The technological effectiveness of the improved system of development was determined by comparison with the development system for an immobile GNK. The ultimate anticipated oil yield was determined by a method developed by VolgogradNIPIneft.

Computations showed that the improved system of development, compared to the one in use, should increase the ultimate oil yield by nine percent.

Measures to adopt it were completed by 1983. The planned volume of pumping was reached at an average well intake rate of 900 m^3 per day, an average injection pressure of 6 MPa, and an average repressuring of 2.8 to 10 MPa. During the water pumping, clogging was noted of the injection well bottoms, but after chloride treatment their intake rate was restored. Pumping in volumes exceeding the withdrawal of liquid made it possible to restore formation pressure, the current value of which is in excess of 14.5 MPa on the average per formation. It is intended to increase formation pressure to 15 MPa.

At the same time water losses to the zone beyond the contour increased, and amounted to 40 percent of the amount of pumping in the outer row of wells. Pressure losses from the injection lines to the current-dividing rows decreased over time, which makes it possible to conclude that it is not advisable to bring the injection zone close to the withdrawal zone. As a result of the partial restoration of formation pressure, flow production was renewed for several wells, the relative consumption of gas for gas-lift recovery decreased, the well sucker-rod pumps worked nearly three times faster, and the current gas factor was reduced. As a result, the rate of decline of oil yield

was substantially slowed. Reserves are now being extracted that were increased by the improved system of development.

Analysis of the displacement of the oil-presence contours has shown that the outer contour shifted along the entire perimeter inside the pool practically parallel with the initial position to a line matching the displacement of the second and third rows of wells, and did not change between 1983 and 1985. As a result of within-contour flooding an outer contour of oil presence formed along the row of injection wells, and an inner contour of oil presence was not noted. Oil was replaced throughout the formation relatively evenly. The current saturated volume of rock is located in a ring along the perimeter of the pool between the second and the fifth rows of wells, and partially in the area taken in by the within-contour flooding.

The oil yield, calculated by the methods of VolgogradNIPIneft [1] for 1981-1985 matched the design value.

Monitoring the development processes included system-wide and individual measurements of the output and intake rate of the wells, water cut, gas factor, bottom-hole and formation pressure, plotting the curves of pressure restoration in flowing and gas-lift wells; observation of the displacement of the VNK and the GNK through test wells by the methods of field geophysics and of the advance of pumped water by the density of the associated water, and the investigation of the intervals of intake rate with the aid of thermometry, the thermoconductive flow meter, and other devices.

In the first years of developing a pool a steady hydrodynamic barrier was created, as witnessed by the profiles of the pressures set up along the flow lines taking in the zones of withdrawal of oil and of gas from the gas cap, and the zone of within-contour flooding. The existence of this barrier established the pressure along the injection line at a higher level than in neighboring zones. At the same time steps were taken to accelerate the creation of a water-encroached zone along the injection row. In order to direct the pumped water primarily along the row of wells, the pumping is done through one of them that is fully exposed to the permeable part of the column, and the neighboring wells are used as producing wells with increased withdrawals. After substantial encroachment these wells are also converted to injection. The distribution of the pumped water was traced by the change in density of the associated water as a result of its decreased salination. The data obtained were generalized by constructing profiles and charts of isodensities in accordance with the methodology [2]. As a result there were established both zones of complete desalination and the main direction of spread of the pumped waters. Profiles with current dividers are also constructed, and on their base charts are drawn of the contours and thicknesses of the developed volumes of a pool, which make it possible to monitor the displacement of the contours of oil- and gas-presence and of the outer contour of oil presence set up along the injection row of wells. Knowing the initial and developed volumes of a pool has also made it possible to monitor the entire process by the balance method.

Analysis has shown that just one year after the start of flooding reliable

separation of the oil- and gas-saturated zones of a pool had been set up and continued in existence in all the following years, and this ensured their independent development and planned levels of oil yield.

From the generalized data of Volgograd Oblast as a whole it is clear that in pools with gas caps under various geological-physical conditions there have been adopted systems with gas-cap expansion, with a GNK immobilized by maintaining formation pressure in the pool or drawing off the required volume of gas, with partial or complete gas blowoff, and with artificial stimulation (beyond-contour, barrier, or within-contour flooding). These systems mainly replaced less effective ones. As a result of adopting several of these systems at several formations it has been possible to show their efficiency relative to each other and their efficiency when compared to a system with an immobile GNK.

The system with expanded gas cap is less rational and can seldom be used. This system, because of its less than complete displacement of oil by gas and gas-contamination of the wells, produced the lowest rates of oil withdrawal and ratios of oil yield, and had comparatively long development times.

Operating pools with an immobile GNK in principle precludes the gas contamination of the wells in the zone abutting the gas cap and increases oil yield. However, maintaining an immobile GNK is a hard task to perform, and thus in the final stage of development the sub-gas zone is operated as an oil fringe, and most often under conditions where gas and water cones are formed. The gas reserves are therefore preserved for a long time.

Partial gas blowoff from a gas cap proved to be more rational than the two preceding methods, since that made it possible to increase current oil withdrawal and ultimate oil yield. Both partial and complete gas blowoff caused oil to be displaced into a previously gas-saturated volume, and it was withdrawn mainly through the wells that had drawn off the gas. After the withdrawal of the commercial reserves of gas, the pools are operated as oil pools. This system made it possible to substantially increase the ultimate oil yield at a development rate close to the withdrawal rate of purely oil formations, and at the same time to extract the gas from the gas cap.

Beyond-contour flooding was normally employed along with other systems. As a result, it was possible to maintain formation pressure or slow down its rate of decline and to prolong flow-production operation, which helped to maintain high rates of oil withdrawal.

The most effective systems proved to be barrier and within-contour flooding. Pumping water into the barrier or inner row of wells made it possible to isolate the gas-saturated part of the pool from the oil-saturated part and to develop them independently. As a result of this, conditions were improved for developing the reserves in the sub-gas zone, there was a substantial increase in well output, the rate of oil and gas withdrawal, and ultimate oil yield, and a decrease in the total time to develop a pool.

The systems enumerated make it possible to obtain different ultimate oil

yields. The greatest oil yield is achieved by employing barrier and within-contour flooding and completely blowing off the gas from the gas cap, and the smallest, by using a system of expanding the gas cap. The ultimate oil yield of the gas caps is comparable to the oil yield of gas pools developed by active methods.

Experience has shown that when operating pools with gas caps there is every possibility of achieving operating efficiency that approaches the efficiency for oil pools.

The measures undertaken were aimed at intensifying withdrawals of oil and gas and at increasing ultimate yield, and therefore the main systems of developing pools with gas caps must be intensive systems that approach the withdrawal rate and oil yield of purely oil formations (systems with artificial stimulation of the gas reserves of the gas cap). Preserving a gas cap in a formation generally causes gas contamination of the wells, reduces the withdrawal rate, and increases development time.

The experience of developing the pools of Volgograd Oblast is evidence of the effectiveness of converting a system to a more intensive one even at the third stage of developing pools confined to fractured collectors with large water-filled and sub-gas zones (the Yelanovsko-Livenskiy stratum of the Bakhmetyevskiy area, and the Bobrikovskiy stratum of the Korobkovskoye field.)

Analysis of the operating efficiency of the development systems adopted has demonstrated that, under conditions where the ratio of oil displaced by gas is less than that displaced by water, the development systems for pools with gas caps can be ranked in the following order of increasing operating efficiency: the system employing expansion of the gas cap, maintenance of an immobile GNK, partial and complete blowoff of gas from the gas cap, and barrier (within-contour) flooding.

From the experience accumulated it can be considered proven that various systems can be used to develop the majority of pools with gas caps. The advisability of applying a specific system to a particular formation must be based on the results of investigating the operating and technical-economic efficiency of the method of development under study, and on whether or not the conditions are met that determine the suitability of using it [3]. It must therefore be kept in mind that the efficiency of a system of development at the early stages depends substantially on the proper determination of the geological structure of the formation and on its natural status at that time. Since this information is generally not precise, the system must be designed with enough flexibility that after ascertaining the structure it can be altered to improve the effectiveness of adopting it.

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OIL AND GAS

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METHODS TO IMPROVE GAS, OIL PRODUCTION DETAILED

Moscow NEFTYANOYE KHOZYAYSTVO in Russian No 4, Apr 86 pp 36-42

[Article by Ye. P. Yefremov, A. S. Kuvshinov, N. Ye. Pavlov, A. G. Telishev, and V. M. Revenko (Glavtyumenneftegaz) [not further identified]: "Improving the Development of Western Siberian Gas-Oil Deposits"; passages rendered in all capital letters printed in boldface in source]

[Text] The opening up of the gas-oil fields in Western Siberia has made it necessary to solve various problems of rationally developing them. Of the 52 developed fields, 8 include gas-oil pools. Among them are the A_9 and A_{10} formations of the Lyantor field, A_{7-8} of the Yaun-Lor and Bystrin fields, A_{5-6} of the Fedorovo field, B_4, B_5, B_6, V_3^2, B_{10}, Yu_1^1, and Yu_1^1 of the Varyegan field, B_8 of the Tagrinskoye field, A_1 and A_{2-3} of the Samotlor field, and B_8 of the Vyngapur field.

The permeability of the reservoirs of these pools varies from 0.028 (the B_8 formation of the Vyngapur field) to 0.400 mkm^2 (the A_{10} formation of the Lyantor field and A_{5-6} of the Fedorovo field). The gas factor in the oil zone varies from 45 to 200 m^3/t.

A feature of all the pools mentioned is the presence of an extensive zone of gas-oil contact tens or hundreds of square kilometers in area with a small gas-saturation layer (less than 15 meters).

Since the development of these gas-oil pools, 470 million tons of oil have been extracted, and 640 million m^3 of water have been withdrawn. There is a stock of 5,600 producing wells and 2,100 injection wells, and the daily output of oil is 200,000 tons. Most of the oil has been produced from the A_1 and A_{2-3} gas-oil formations of the Samotlor field. Fifty percent or less of the program well stock has been achieved here. For the remaining gas-oil pools achieving the program solutions is still at the initial stage.

The simultaneous occurrence of oil and free gas that sharply differ in mobility affects the conditions of developing the gas-oil pools: during withdrawal from the oil zones, gas may break through as a result of expansion of the gas cap, and this complicates the process of oil extraction. The oil fields of Tyumen Oblast therefore employ methods that will limit or completely preclude interaction of the gas cap with the oil fringe.

Let us examine some results of developing gas-oil pools, using the example of the A_1^3 and A_{2-3} formations of the Samotlor field.

FORMATION AV_1^3. In conformity with the program development for this formation provision was made to cut off the gas cap from the oil part of the pool by a single ring of barrier injection wells, located between the outer and inner contours of the gas pool. The design stock consists of 110 barrier wells. The barrier ring divides the gas-oil zone (GNZ) into two parts, and 74 producing wells are located in the outer part.

Inside the barrier ring the program provides for drilling 115 oil wells and 35 gas wells. The gas wells are distributed evenly in the area of the gas part of the pool.

In the program for the AV_1^{1-2} formation in a development zone of monolithic sandstone (delta), the GNZ had to be separated from the gas and purely oil zones by two barriers of injection wells. The outer and inner rings of them were located along the corresponding contours of the gas pool.

The status as of 1 January 1985 was that in the AV_1^3 formation 98 barrier wells (89 percent) were being developed by pumping, and in the AV_1^{1-2} formation 19 wells an the outer barrier ring and 10 wells in the inner ring were being developed by pumping. Erection of the barriers is virtually complete. The cumulative output of oil amounts to 7.5 million tons, and 12.8 million tons of liquid, and the water cut presently equals 64 percent.

Development of the barrier system of injection checked the expansion of the gas cap that was noted and cut off the oil zone from the gas zone. Producing wells are now observing reduced wellhead pressures and increased outputs of liquid.

From the data of the radioactive logging (RK) and electrometry of wells in flooded zones, in certain sectors the water front has advanced 1.5 to 2 km in the direction of the gas cap. For supplementary exploration of the pools and probe of intervals where gas was replaced by liquid, producing wells 27432 and 27434 were drilled, which turned out to be in an almost completely soaked zone, and were worked with a water cut of 99 and 95 percent, respectively.

In the sector of the pool where there was a broad sub-gas zone, because of the large volumes of water pumped into the barrier wells, the oil reservoirs were shifted from the site of the program's producing wells into the gas part. To develop these reservoirs and increase the oil yield, the following measures were adopted: additional perforation of formation AV_1^3 in the injection wells of formation AV_{2-3}; additional perforation of formation AV_1^3 while replacing gas with liquid in the producing wells of formation AV_{2-3}; restoration of the wells from formation BV_8 to formation AV_1^3.

In the southeast sector, in an area of extensive junction between formations AV_1^3 and AV_{2-3}, oil was being driven from formation AV_{2-3} into the gas cap of formation AV_1^3 to a distance of 250-500 meters beyond the junction zone.

Measures were therefore undertaken to develop the oil reservoirs displaced from formation AV_{2-3} into the gas cap of formation AV_1^3, by perforating formation AV_1^3 with the producing and injection wells that were drilled in formation AV_{2-3}.

To prevent the escape of oil into the gas zone of the pool, part of the barrier wells were shut down, and pumping was reduced throughout the entire barrier ring. In this way, development of the gas-oil zone proceeded satisfactorily; accomplishment of the measures recommended in 1985 made it possible to develop additional oil reservoirs and to improve the process of working the reservoirs.

A negative aspect was the escape of oil through the junction between formations AV_1^3 and AV_{2-3} into the gas part of AV_1^3.

FORMATION A_{2-3}. In conformity with the program, the GNZ of formation AV_{2-3} is also being developed by employing barrier flooding. The outer barrier ring runs along the outer contour of the gas pool, inner ring No. 1 along the four-meter isopach line, and inner ring No. 2 along the two-meter isopach line.

Between the outer and the No. 1 inner barrier rings in monolithic collectors provision was made to locate only producing wells, and in development zones of thin-layer sandstones, producing and focal [ochagovyy] wells were located.

Between the No. 1 and 2 inner rings drilling was programmed for 63 producing wells at intervals of 375 meters. The program well stock relating to the GNZ consists of 455 wells, including 268 oil wells, 6 gas wells, and 181 injection wells. Development of the zone has been accompanied by an increase in oil output, and 1.982 million tons of oil were produced in 1984.

During 1984 liquid output in the zone increased by a factor of 1.27, as a result of adopting the mechanized method of developing the wells. Compared to 1983 the zone's average yield increased by a factor of 1.24 and amounted to 211.8 tons per day, however, the reserves of liquid for withdrawal have not been exhausted. As of 1 January 1985 the zone's producing stock consisted of 34 wells requiring measures to be taken to increase their productivity.

As of 1 January 1985 21.6 percent of program producing stock was in operation, and 61.9 percent of the injection stock, of which 45.9 percent were program injection wells being developed by pumping. Of the outer barrier ring 85 percent was being developed by pumping, and 78 percent of the No. 1 inner ring, but pumping had not been applied to a single well of the No. 2 inner barrier ring.

The status as of 1 January 1985 was that construction of the outer barrier had been completed at the development sectors of monolithic collectors, where prior to the adoption of barrier flooding there had been observed a decline in gas-oil contact, an increase in gas factors, and a decrease in yields, not only in the GNZ, but also in the adjacent sectors of the purely oil zone. Construction of the barrier has been supported by field data on the actual

operation of adjacent wells (yields increased, and wellhead pressure was normalized), and by the results of hydrodynamic and geophysical research. According to field data, development zones of monolithic sandstone have been flooded in virtually the entire area of the GNZ. The breadth of the flooded zone varies from several hundred meters in development zones of thin-layer sandstone, up to 2 to 2.5 km in development sectors of monolithic collectors. The rate of advance of the water front in monolithic sandstone of a GNZ fluctuates between 250 and 500 meters per year, which corresponds to the rate in purely oil zones.

Data from RK [radioactive logging] demonstrate that in sectors of collector development an increase is taking place of gas-oil contact (GNK), and a displacement of gas by liquid, i.e., the GNZ is gradually being transformed into a flooded, purely oil zone. According to the results of research performed in 1984, zones have been created in which gas has been replaced by liquid up to the roof of the AV_{2-3} stratum. It is recommended that these zones be perforated with producing wells to the roof of formation AV_{2-3} to increase liquid withdrawal and intensify the development of the GNZ.

During 1982-1983 in formation AV_{2-3}, in a zone of effective thicknesses and where gas had been replaced by liquid, there was additional perforation in 21 wells. This measure was effective throughout the entire zone, since it made it possible to convert several wells simultaneously to mechanized extraction and to obtain approximately 358,000 additional tons of oil annually. The following data testify to the effectiveness of the additional well shooting .

Liquid yield, tons/year:	
before perforation	188
after perforation	477
Water cut after perforation, %	83
Increased yield, tons/day:	
liquid	289
oil	49
Increased oil yield, thou. tons/year	358

However, additional shooting of producing wells is not always indicated. For example, at well 14311, prior to additional perforation an interval was perforated represented by Type 2 thin-layer sandstone, and additional perforation of the monolith occurring in the roof of the stratum was carried out in 1983. Following this there was a sharp increase in the water cut of the product, which was 99 percent as of 1 January 1985. It therefore became necessary to isolate the monolith encountered. After the additional perforation only 348 tons of oil were obtained. Additional perforation of a flooded monolith is therefore not recommended in waterless wells developing the lower part of a stratum made up of Type 2 thin-layer sandstone and lenticular monoliths.

The average formation pressure in a withdrawal sector in a GNZ amounted to 17 MPa in 1984, however it was measured mainly in development zones of monolithic sandstone, where the current formation pressures often exceed the initial pressure. In development zones of thin-layer sandstone, which have been studied considerably less, formation pressure is lower than the initial pressure.

In certain wells it equals 14.7 to 14.8 MPa, or even 12.9 MPa (well 14163). This is due to non-acceptance of the focal system of operation in development zones of thin-layer sandstone, as a result of which several focal producing wells have had to be converted to pumping.

The development program provides for the active development of GNZ reservoirs with small oil-bearing strata (from two to four meters thick) by setting up the No. 2 inner barrier ring along the two-meter isopach line, and drilling producing wells between the No. 1 and 2 inner rings. From the results of radioactive logging in the area of injection wells the displacement of gas by liquid has been noted, i.e., the water from the No. 1 inner barrier ring advanced 500 to 1,000 meters in the direction of the gas zone. There are no data from other areas on the advance of the water front beyond the inner barrier ring.

Overall development of the GNZ was in conformity with the program. The barrier system was effective, especially in development zones of monolithic sandstone. A negative factor was overcompensation for liquid withdrawals by pumping in sectors where the clay sections were not thick enough, which caused liquid to be driven into the gas-saturated volumes of formation AV_1. Resources for further expansion of liquid withdrawals are related to increasing the productivity of several low-yield wells, drilling infill wells in development zones of Type 1 thin-layer sandstone, and adopting the area system of operation in them.

The presence of gas caps and extensive GNZs was noted at 20 or more formations being developed. They can be arbitrarily divided into two groups according to principles of development and design solutions adopted. The first involves formations where the main commercial reserves are concentrated beyond the limits of the gas contour. Formations AV_1^3 and AV_{2-3} of the Samotlor field are typical examples of these formations. When designing and developing formations of the first group the main task was to prevent negative impact of the gas caps on wells in adjacent purely oil zones. Barrier flooding was employed for this purpose.

Prior to barrier flooding and in sectors where the organization of barriers lagged behind technological development requirements and where oil withdrawal was therefore intensive, wells were observed to have increased wellhead pressures and gas factors.

According to radioactive logging data, flooding in monolithic sandstone goes faster (similar to purely oil zones) in pumped areas. In this case, if there are no clay sections between the gas-saturated and the oil-saturated strata, oil from the oil stratum migrates to the gas stratum. This is because oil driven by water from an oil-saturated stratum can be moved with less energy 5-10 m into a gas stratum where initial formation pressure has been maintained than it can filter hundreds of meters horizontally.

Oil introduced by pumping water is distributed throughout the entire gas stratum, i.e., the GNZ is transformed into a purely oil zone at the stage of water encroachment. From the intervals where gas is replaced by liquid, oil and

water are extracted, since the water cut of the initially gas-saturated stratum is approximately the same as for the oil stratum.

In some cases additional perforation of the displacement interval yields a temporary decrease in the water cut of the wells. This mainly happens when the additional perforation is done right after radiation logging data have established gas displacement by liquid, and is apparently related to the formation of an oil bank. However, the results of worcing these wells demonstrates that after four to eight months the water cut will again increase.

With the approach of the water front to producing wells with elevated wellhead pressure and gas factor, a reduction in the latter has been observed to the values corresponding to the wells of a purely oil zone. Radioactive logging data have demonstrated that increase in wellhead pressure and gas factor is generally related to an expansion of gas caps that has been highly irregular in area and determined by the nature of the geological structure of the formations.

By area and cross section of the formations one can divide zones of increased sandiness, where the main development is monolithic sand bodies four or more meters thick, and clay zones that alternate thin-layer sandstones and clay bands. In wells tapping thin-layer sandstone in a purely oil zone, gas breakthroughs have not been observed. The expansion of gas caps has occurred exclusively in development zones of monolithic bands. In certain sectors fingers of gas have advanced a distance of three kilometers.

After barrier wells have been developed by pumping in development sectors of monoliths, the gas is replaced by liquid. According to radioactive logging data the water front advances through the entire thickness of a formation, and in some sectors it penetrates along the roof a distance of 1.5 to 2 km into the gas cap. This causes an increase in formation pressure of 4-5 MPa in the pumped zone, and effectively isolates the purely oil zone.

By drawing off the cutoff gas contained in the breakthrough fingers, the dimensions of the fingers are reduced because of the replacement of gas by oil and water. As a result there is a reduction of the gas factor and in the number of wells with increased wellhead pressure. After the start of water encroachment into the previously gas-filled wells, the gas factor and the wellhead pressure are close to the corresponding indicators for wells of a purely oil zone.

In accordance with field data the advance of a water front in development zones of monoliths is similar to that in purely oil zones without substantial passage through the gas stratum. The dynamics of water encroachment by the level and rate of its expansion are close on the average to the dynamics of water encroachment in wells of a purely oil zone. Thus, no substantial negative consequences were noted from introducing a limited amount of gas from the gas cap into the purely oil zone, either in the rate of oil withdrawal, or in the oil yield of the formations, and it is therefore feasible to locate barrier wells in narrow GNZs along the inner contour of the GNK, in order to prevent oil from being driven into the gas cap.

For small gas caps development can proceed by normal systems of flooding, with injection rows or sources located close to the gas cap. An example is the development of the central zone of the AV_{4-5} formation, where local gas caps were developed after pumping water into the central dividing row without complications.

The system of barrier flooding in the Samotlor field is virtually complete. It has made it possible to eliminate the negative effect of gas caps on the development of adjacent purely oil zones and to maintain a high rate of oil withdrawal through the formation as a whole.

Barrier flooding has also proven effective at the Varyegan field. This was started in the B_6, B_7, and B_3^2 development formations in 1978. The development and startup of the barrier wells went on simultaneously with the bringing into operation of producing wells in sectors adjoining gas caps. Barrier wells for each formation were sited in an oval in the middle part of the zone under the gas. The interval between neighboring barrier wells and the closest producing wells to them was 600 meters. Barrier flooding had a positive effect on the development of the pools and made it possible to withdraw oil at quite high rates without noticeable expansion of the gas caps. Prior to 1980 the gas factor was 200-250 m^3/m^3. In 1980-1981 it sharply increased to 800-1500 m^3/m^3, and in 1983-1984 it went down to 150 m^3/m^3.

At the B_7 formation the liquid yield increased in 1980-1984 from 116 to 149 tons per day, at formation V_3^2 -- from 141 to 203 tons per day, and at the B_6 formation it was virtually unchanged (154 to 160 tons per day). Thus, the experience accumulated in developing oil-gas pools of the first group of formations, where the main oil reserves are concentrated in zones adjacent to a gas cap, is evidence of the effectiveness of barrier flooding.

The second group of formations refers to those with extensive GNZs, which must be divided into independent development zones. Typical examples of these formations are the AS_{9-11} formations of the Lyantor field, and the AS_{2-3} formations of the Samotlor field. It was planned to develop them by methods of active flooding. At the Lyantor field, in the process of drilling the first section, groups of cross sections were discovered that differed in the nature of their saturation and in the presence or absence of clay bands more than two meters thick at the boundaries of the gas-oil or oil-water sections. Recommendations were made for the perforation of each type of cross section. At the Lyantor field this measure was carried out in many stages. In the first stage the non-contact zones were perforated, and the contact zones in subsequent stages.

At the Samotlor field the GNZ of the AV_{2-3} formation was separated into an independent development formation by drilling a second barrier ring located along the four-meter isopach. The producing wells were sited in a triangular pattern in sectors where monolithic sandstone occurred.

In injection and producing wells intervals have been discovered mainly beneath natural clay shields. Field data have shown that the way of developing

producing wells in a waterless period is determined by the thickness of the clay section between the GNK and the perforation interval, and also by the thickness of the gas layer. Where there is no clay section, or where it is not very thick (less than two meters) and the gas layer is more than three or four meters thick, the gasless period of operation is short or totally absent, and well operation is unsteady. With increase in thickness of the clay section well operation is more steady, and in most cases gas breakthroughs have either not been observed or have no negative impact on the wells' oil yield. Water encroachment in wells of GNZs exposing monoliths proceeds at the initial stage at higher rates than for wells of a purely oil zone, but when starting with a water cut of 60 to 70 percent, the dynamics of water encroachment are similar.

Therefore, if there is no loss of oil in wetting the sandstone of the gas layer, the oil yield of a GNZ will be at the level of a purely oil zone, while the development of the GNZ will take place with increased water-oil factors (approximately 8-10), because of the small waterless output. For example, for the GNZ of the AV_{2-3} formation as of 1 January 1985 the oil yield was 0.12 for pumped liquid in the amount of 0.18 of interstitial volume and a current water cut of 62 percent.

The developed sector of the GNZ of the AV_{2-3} formation in the Samotlor field is essentially the leading zone for the overall gas cap of the group A formations. The gas layer of this sector is highly saturated with oil. However, data from core analysis indicate that the oil saturation of the main volume of gas caps is between one and five percent. These results have been obtained from most of the formations of the Varyegan, Lyantor, and Fedorovo fields. Since with flooding in zones where there is no clay section, the entry of oil into the gas portion is inevitable, and active pumping of the water in them causes oil to be lost in wetting the sandstone of the gas layer.

To reduce losses in oil output it is advisable to refrain in the initial stage of development from pumping water in sectors where the gas part of a formation has a low oil saturation, and where there are no divisions between the gas and oil layers. In this case it is advisable simply to withdraw oil and gas by shooting wells under the clay bands, which will serve as shields from the gas layer. Withdrawals of oil and gas in these sectors can be compressed by pumping into adjacent sectors or into special injection wells located in the center of the gas cap.

Conclusions

1. In fields with large gas caps and narrow GNZs (up to 2 km) it is advisable to segregate the gas cap from the development zones by pumping water from part of the wells of the main pattern located on the inner contour of the gas pool.

2. In fields with small gas caps (up to 2 km in width) normal flooding methods should be used that provide for the pumping of water into the gas cap.

3. Pools with extensive sub-gas zones may be developed by pumping water only in sectors where there is the required oil saturation of the gas layer or

reliable barriers to prevent the entry of water into the gas cap.

4. In sectors of a GNZ where large losses oil may be caused by its displacement into the gas layer, it is advisable to withdraw oil and gas mainly by perforation of the bottom portion of the formation and by maximum utilization of natural shields.

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OIL AND GAS

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LYANTOR EXPERIMENTAL RESULTS DESCRIBED

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[Article by N. Ya. MEDVEDYEV (Surgutneftegaz) [Surgut Oil-Gas Association]: "Results of Experimental-Industrial Operation of the Lyantor Gas-Oil Field"]

[Text] The Surgutneftegaz Association is developing the oil-gas pools of the AS_{4-11} formation at the Lyantor, Bystrin, Fedorovo, and Yaun-Lor fields. This article examines in detail the results of operating the Lyantor field.

This field was opened in 1965, is located on the western slope of the Surgut vault, and confined to the brachyanticlinal fold of the meridional trend, with dimensions of 20 X 70 km. The gas-oil pool is confined to the AS_9, AS_{10}, and AS_{11} formations of the Hauterivian-Barramian Age. The depth of the occurrence of productive formations is 2100-2156 meters, water-oil contact (VNK) decreases from north to south from 2040-2042 to 2056-2060 meters, and gas-oil contact (GNK) is located at the 2034-3038-meter marks. The volume of the gas-bearing part is 48 percent, and of the oil fringe 52 percent.

The pool is stratal and anticlinal, its overall height is 60 meters, the height of the gas part is 45 meters, and the average thickness of the oil fringe is 15 meters. Bottom water everywhere underlies the oil fringe, the oil contains paraffin (paraffin content is 2.52-3.35 percent), low in sulfur (sulfur content is 0.9-1.9 percent), and its density is 0.91-0.98 t/m^3. Bubble-point pressure varies from 11 to 19.7 MPa, viscosity under formation conditions is 4.5-5.6 mPa X s, initial formation pressure is 21 MPa, and the gas factgr is 60 m^3/t.

Planned drilling for the field is 1912 producing and 783 injection wells by the nine-point area system. The field was put into operation in 1978. There have been 1383 wells drilled at it, and the existing stock consists of 847 oil wells and 227 injection wells.

Drilling volumes have systematically increased (from 133,000 meters in 1979 to 750,000 meters in 1985), and oil extraction exceeded plan levels by 1.301 million tons in 1984, and by 1.442 million tons in 1985. This was helped by a more favorable process of watering the wells and by their actually greater yield compared to what was contained in the operating plan. Water

encroachment of the wells amounted to 45 percent.

The most important features of developing the Lyantor field have been the rational selection of the perforation interval, and ensuring reliable formation isolation in the producing part of a column.

In the initial period the wells were cemented by the method normal at other fields, but since 1983 this work has been done under a special regulation by installing drill stem packers above and below the perforation intervals (in 131 wells), or special cement-resin mixtures were used (in 52 wells). The completion and subsequent operation of these wells has demonstrated the effectiveness of these measures. In the initial period water encroachment was less than for normal cementing, and crossflows of water and gas were not observed.

Perforation intervals were selected in accordance with the presence or absence of dense bands in a formation in an area of gas-oil contact or water-oil contact. The presence or absence of a dense band called for a differentiated approach to the selection of the perforation interval for each well.

In the first stage only purely oil bands 4-6 meters distant from gas-oil contact or water-oil contact were discovered in producing wells. After flooding of the wells and conversion to mechanical extraction, there was additional perforation of the water-oil contact (22 wells were further perforated on 1 July 1985). The results of short-term operation do not allow definite conclusions to be drawn of the effectiveness of this measure.

In the injection wells perforation tapped the whole oil-bearing thickness -- from the water-oil contact to the gas-oil contact -- by taking account of the intervals tapped in the surrounding producing wells. The producing and injection wells were perforated by PK-103 perforators, with a perforation density of 10 holes per meter.

In connection with the structural complexity of the pool, the presence of injection barriers in an area of gas-oil contact and water-oil contact, the large number of wells (60-70 percent) in which bands are totally absent or less than two meters thick (so-called contact-gas zones), and the quite low anisotropy of the formations (1:4), the producing wells are being completed under special regulation. Flow is induced by compressor. To limit depression into the formation, starting sleeves are installed at various depths depending on the nature of the column and the perforation interval chosen. The injection wells are completed by the traditional method: after a short tryout they shift to flushing with water with subsequent completion with test injections by the TsA-320 unit under pressure of 10-15 MPa.

However, these measures do not make it possible to avoid considerable watering of the wells both at the start of operation or in later periods. Generally, 30 percent of producing wells are watered from start of operation, and their water cut amounts to 2 to 25 percent, but after three months it rapidly increases to 50 percent. In this period between 400 and 75,700 tons of oil are withdrawn from these wells. With a water cut of 50 percent the wells cease to flow. The remaining wells are watered in the first three to four

months after start of operation. The presence of thick separations has not been observed to bear a strict relationship to the intensity of watering.

The wells are operated with a bottom-hole pressure of 14.1-20.9 MPa and depression into the formation of 1-6 MPa (average depression is 3.4 MPa), and oil yields amount to 5-150 tons per day (average yield is 24.9 tons per day).

As of 1 September 1985 the watered well stock consisted of 691 wells, or 74 percent of all producing wells, of which 127 were watered by injection.

As a result of research by geophysical methods at 337 wells, it was established that virtually all the perforated intervals are taking part in the work, and that water is advancing from the lower intervals. In 22 wells (6.5 percent of those studied) water had advanced along the cementation ring. Isolation studies were made at two wholly watered wells. Positive results were obtained at the well in which there were thick separations in the formation column. In the well without separations virtually no effect was obtained.

Hydrodynamic methods were employed to study 155 producing wells (indicator curves were constructed for 58, and KVD [not further identified] for 97). Productivity varied from 3 to 62 tons/(day X MPa), and average productivity was 16.2 tons/(day X MPa); permeability amounted to 0.06-0.419 mkm^2 (average permeability was 0.156 mkm^2).

During the process of operating the field, elevated gas content was noted in 198 wells. The gas factor in them fluctuated from 100 to 2000 m^3/t and more. A large number of wells with elevated gas content were located in zones with no thick barriers, and where the oil came into contact with the gas.

Adopting the system of stimulation reduced the number of wells with an anomalous gas factor. By early 1985 only 88 of them could be counted, in 19 of which the gas factor exceeded 500 m^3/t, and in 53 it was more than 1000 m^3/t. These wells were generally located close to the central and more highly gas-saturated zone of the pool. They are producing 16.6 percent of the total oil yield, and 3.5 million m^3 of gas have been taken from the gas-saturated zone. The monthly output of this gas amounts to 130-150 million m^3. In certain sectors of the field gas taken from the gas-saturated zone is used for natural-pressure gas lift. Gas is also withdrawn through gas-intake wells.

The output of the gas wells varies from 160,000 to 940,000 m^3 per day, bottom-hole pressure is 14.6 MPa, formation pressure is 20.1 MPa, and productivity is 83 t/(day X MPa).

From the very start of development of the field, work began on forced extraction of liquid from the wells. Because of a lack of equipment needed for the planned natural-pressure gas lift (BKG), a large number of wells are being operated by the method of blowing from below from a gas well or wells with elevated gas content.

The wells are being operated by the following methods:

1) flowing (312 wells), which provides 41 percent of the daily oil yield, and their average oil output is 25.3 tons per day;

2) blowing from below with the use of natural-pressure gas lift without subsurface equipment (344 wells), making it possible to obtain 40 percent of the daily oil yield, or an average oil output of 12.3 tons per day;

3) natural-pressure gas lift with subsurface valves (50 wells), thus providing 6 percent of the daily oil yield, or an average oil output of 23.2 tons per day;

4) with the aid of ETsN [electrical centrifugal pumps] (226 wells), for a daily yield of 16 percent, or an average oil output of 17.5 tons per day.

Operating wells by the method of blowing from below is highly unreliable, especially in wintertime, when there there is increased formation of hydrates in the wellhead and borehole system.

In 1984 specialists of the Surgutneftegaz Association proposed using electrical centrifugal pumps in wells that have reliable casing of the flow string in the productive part (high-quality hydrated cement, and thick barriers from the gas at least four meters thick).

For gas-oil pools in sub-gas zones, where a gas breakthrough could occur in any well, the association has developed special geological-technical specifications for switching the wells of the Lyantor field to electrical centrifugal pumps, which call for: 1) grading of wells (the product must have a normal gas content of about 100 m^3/t, the flow string must be well cemented, and the column must have thick barriers against gas-oil contact);

2) well preparation (pressure testing by lowering the level for determining possible gas breakthroughs when operating a well with electrical centrifugal pumps);

3) preparation of above-ground equipment (manufacture of a special stuffing box for cable inlet at a pressure up to 20 MPa and back pressure valves on the manifolds to protect the oil collection system);

4) mandatory completion of focal wells by pumping in an area of producing wells converted to electrical centrifugal pumps.

As of 1 January 1985 226 wells were equipped with electrical centrifugal pumps, the average output of liquid was 41.7 tons per day and of oil 17.5 tons per day, dynamic levels were measured at 30 to 1300 meters, and depth of pump running-in was 1100-1400 meters. The wells were operating satisfactorily.

However, the use of electrical centrifugal pumps is restricted by the following factors.

1. High (11-19 MPa) bubble-point pressure that varies from area to area

(average value is 16 MPa).

2. Presence of thick barriers in columns in only 30-35 percent of the wells, and small extent of the zone with no gas cap (18 percent of the total area of the field).

3. Inadequate delivery of equipment meeting the reliability requirements of stuffing-box inlet (up to 20 MPa of pressure) and furnished with special valves on the manifolds.

To ensure the steady operation of producing wells it is still an urgent matter to accelerate the construction of compressor units and to expand the field of use of natural-pressure gas lift and electrical centrifugal pumps under the conditions of a gas-oil pool.

The nine-point area system of handling a pool has been 70-percent adopted in the developed part of the field. In order to create a margin from the start of development, thermal Cenomanian waters are pumped into the formation. Forty-eight water-collection wells have been drilled for this purpose.

Daily pumping amounts to 70,000 m^3, and current compensation for withdrawal by pumping is 119 percent. The intake rate of the wells varies between 50 and 1000 m^3 per day (average intake is 348 m^3 per day). Injection pressure is 6-13 MPa. Compensation for withdrawal by pumping at the start of development was 103 percent, because of gas extraction from the gas cap. The rate of advance of injected water did not exceed 250 meters per year.

From the results of studying 174 injection wells it has been determined that perforation intervals take in water mainly in the lower or more monolithic bands. In 38 wells (22 percent of those studied) crossflow of water has been noted, including 24 wells in the upper column, and 14 in the lower. When fragmented and monolithic formations are exposed simultaneously, water intake is mainly in the monolithic.

According to data on 162 injection wells studied by hydrodynamic means the coefficient of productivity varies from 3 to 100 t/(day X MPa), and the average is 28 t/(day X MPa).

Water pumping is regulated by installing restricting chokes in the wells closest to the KNS [compressor pumps]. However, the shortage of flow regulators and means of individual metering did not allow the regulation of water pumped at every unit of the nine-point system.

Periodic measurements of formation pressure demonstrate the satisfactory energy state of the pool.

Let us dwell on estimating the required pumping volumes for gas-oil pools. Normal estimates, which provide only for the extraction of liquid are not adequate for actual development conditions, since, along with liquid, a large amount of gas is extracted from the gas cap and must be taken into account. Otherwise, estimates of water pumping will be in error by 50 percent or more.

Periodic probes at 132 wells to determine the location of gas-oil contact reflect that its position is unchanged. Only in five wells located close to injection wells was an elevation of gas-oil contact of 2-5 meters noted, and this was probably related to the formation of oil banks in the water pumping zone. It follows from the above that the system used to develop a gas-oil pool can ensure planned levels of oil output.

Adopting this system of stimulation reduced formation pressure in certain sectors to virtually the initial level. Developing reserves in zones isolated from gas is similar to the exploitation of water-oil zones. Gas-oil contact and water-oil contact remain at the previous levels. Additional well-casing measures improve the quality of formation isolation. The development indicators of the producing formations are close to design values. The brief period of field operation has confirmed the necessity of extensive liquid withdrawal from the very start of development.

There are however, unsolved problems in the development of the Lyantor field, the most important of which, apart from the method of well operation, is the lack of complete utilization of the gas drawn off. The degree of utilization in 1984 was 42.6 percent of the total gas drawn off, and 45-50 percent in 1985. Because of the lag in automation work, the problem of setting up individual metering of wells has not been fully solved. It is essential to improve existing measuring devices in order to accomplish measurements of low liquid yields (from 1-3 up to 10 tons per day) when the gas content is high (from 300 to 5000 m^3/t or more). Problems of continuing urgency are sulfur production and the delivery to the industry's enterprises of special equipment for pumped wells with electrical centrifugal pumps in gas-oil pools. It is essential to continue work to ensure quality well casing. The delivery of flow regulators must be accelerated in order to regulate water pumping. High-pressure mobile lubricators for geophysical work are needed for well study. In addition, geophysical methods must be improved in order to determine the location of gas-oil contact from initial measurements, which must be known when installing drill stem packers and establishing perforation intervals immediately after completion of well drilling.

12697
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IZVESTIYA'S BOVIN ON U.S. MEDIA TREATMENT OF CHERNOBYL

Moscow IZVESTIYA in Russian 14 May 86 p 5

[Article by A. Bovin, IZVESTIYA political commentator: "A Week In New York"]

[Text] At the very end of April and the first days of May I had occasion to visit New York City. At the initiative of the [Alerdink] Fund the fourth meeting of journalists representing East and West was to be held.

But before speaking of this meeting, a few impressions on a different topic. In the standard hotel room at the Barbizon, as usual, there was the standard television set. Thirteen buttons, thirteen channels. And each one of them was pouring out a genuine propaganda tsunami on television viewers: Chernobyl!

Somewhere, either in Indonesia or in Japan, the President of the United States got lost -- his trip to Asia received scarcely any mention. Once again something blew up right there in the United States -- big deal. The "evil" Qadhdhafi and the ubiquitous terrorists suddenly disappeared. Everything was focused on Chernobyl. Terrifying rumors and gossip, shameless lies, pseudo-expert appraisals and profound deliberations by those in the know, satellite photos, and frightened tourists returning from the USSR, harried by reporters. And all this was repeated several times to the tiresome refrain of exasperated statements about the lack of complete and timely information from Moscow.

Yes, during those days there was indeed little information. And we, five Soviet journalists who chanced to be in New York City, felt this much more acutely than did the Americans. Because what had happened at Chernobyl was above all our woe and our pain. What happened there? How did it happen? There was no escaping these questions. But we understood that it takes time to obtain reliable information, and that emergency situations require an especially cautious approach to the nature and volume of information. We, I repeat, understood this and attempted to convey this to Americans.

Whatever the case may have been, the reticence of reports from Moscow in no way justified the outbreak of propaganda hysteria. I will be more precise: words of consolation were heard, but they were barely audible over the background of tactless and crude (I have selected the most polite terms) discussions and statements designed to provoke hostility toward the Soviet

Union. It was announced that 15,000 people had been buried in a mass grave. Then, with disclaimers and evident mistrust it was reported that "only" two persons had died at the moment of the accident. And it seemed that this sort of information was not to the liking of the commentators who were hungry for reliable information. If not 15,000, then at least 10, at least 1,000...

And what good were the blood-red radioactive clouds which were zealously drawn by the television companies and which periodically appeared on television screens over various portions of the map? At first over northeastern Europe, and then over southwestern Europe. Later the sinister red tint stretched across the entire territory of the USSR, encircled Japan and, turning sharply northward, headed toward Alaska and, finally, covered the western portion of the United States. And there was hardly a word (or half a word, or a quarter of a word) about the fact that there was no actual health hazard for the people living in the regions indicated.

I encounter American journalists in one way or another every day as part of my job. I thought that nothing could shock me. But at first I was taken aback by this flagrant lack of conscience. Taken aback by the level of emotions: how can this be, this is a tragedy, a common human tragedy; not so long ago we were mourning together the death of the American astronauts... Taken aback at the level of reasoning and logic, it was all so simple. Those who applauded the invasion of Grenada, who hailed the bombing of Tripoli and Benghazi, could not have reacted to Chernobyl otherwise than they did. They were not ashamed. One is ashamed for them.

Now let us return to the journalists' conference. What is the [Alerdink] Fund? It is an organization whose goal is to strengthen mutual understanding between East and West, using contacts between journalists for this end. The [Alerdink] Fund was created and is financed by wealthy Dutch businessman Frans [Lyurfink]: ([Alerdink] is the name of his suburban residence.) [Lyurfink] himself explains his actions roughly as follows: he roamed the world and earned money. What else was there? He decided to be of service to people, had a wish that people should understand one another better, that they should work together instead of fighting. Hence the fund's goal.

And I should emphasize one other thing. Those journalists who are involved in the fund's work are those who have already made a choice, those who consciously -- each with his own motives and within the framework of his own political views -- wish to work for mutual understanding instead of for disharmony and a worsening of relations between East and West. This defines the methodology of our meetings. We select several specific topics, and we seek some sort of common approach, common orientations, which would make it possible for the Western audience to better understand the East's views, and for the Eastern audience to better understand those of the West. The psychological task is quite complex. Because we have grown accustomed to "clarifying relations," fixing our attention on various viewpoints, but in this case we need to seek their synthesis. And I have frequently caught myself following old habits: I find myself wanting to give a "rebuttal." Which generally is much simpler than seeking out and formulating, as it is currently fashionable to say, a "field of mutually convergent interests."

This time our host was New York University. Taking part in the discussion were journalists from Hungary, the FRG, Poland, the Soviet Union, the United States, France and Yugoslavia. The general framework of the discussion: between the two summit meetings. Three topics, each with a different group of participants: the role of television in the coverage of summit meetings (as a sort of experimental material we used a presentation of commentaries by Soviet and American correspondents in Geneva before we got down to the exchange of opinions); how the Soviet mass media depict the United States and how the American mass media depict the USSR (each side had an opportunity to show the other side several newspaper articles which were typical in their pluses and minuses); and what journalists can and must do in order to contribute to the success of disarmament talks. As you can see, we had plenty to talk about. And we did talk. Incidentally, on a rather intelligent level. Naturally we also discussed the events at Chernobyl. From the standpoint of the lessons which the mass media should learn so as not to turn a human drama into a speculative brouhaha.

The discussion was open to the public. The hall was filled to capacity with university students and local journalists. Lots of questions were asked. And our American colleagues, who led discussions on all three topics, were quite impartial, in my opinion, in allocating time to questions which were not always pleasant. Incidentally, there are no bad questions, only bad answers.

It was the concensus of the participants that the meeting was successful. This does not mean that the representatives of the East convinced the representatives of the West. Or vice versa. This means that we came to a better understanding of each other's argument, logic and attitudes.

12825
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NUCLEAR POWER

NUCLEAR POWER 'KEY' TO RESOLVING ENERGY PROBLEM

Tbilisi ZARYA VOSTOKA in Russian 18 Feb 86 p 3

[Article by A. M. Petrosyants, chairman, USSR State Committee for the Use of Soviet Atomic Energy: "Nuclear Power Is Key to Resolving Energy Problem"]

[Text] Our country's developing economy requires ever-increasing energy support, especially where the population is growing. Power plants which use organic types of fuel -- oil, gas, coal, peat, and shale -- are increasingly having difficulties obtaining these types of fuel, especially during the winter when their extraction and transportation over long distances is greatly complicated.

In addition, coal extraction is becoming more and more complex and expensive. In the central part of the European USSR it is necessary to go deeper and deeper into the earth, to build deep shafts, and to enlist a large number of workers and service personnel to deliver the fuel to the surface.

The use of petroleum as a fuel for power plants is becoming inefficient since oil reserves in the earth's interior are not that great.

All these complications with the extraction of traditional types of fuel can be in large part mitigated with the use of a new energy source which is dependable and has been successfully mastered by human beings -- atomic energy.

The high "caloric value," energy-intensity, and concentration per unit of mass of nuclear fuel distinguish it sharply and advantageously from all other types of energy raw materials.

We know that when uranium nuclei are split in a nuclear reactor an enormous amount of energy is given off, and its use makes it possible to build industrial-type atomic power plants (AES's). One act of splitting a uranium nucleus gives off energy equal to roughly 200 million electron-volts (200 Mev). This is more than 200 million times greater than the energy given off for one atom in a chemical reaction.

But if we move to more ordinary units of measure, the "combustion" of one kilogram of uranium-235 produces about 23 million kilowatt-hours of energy, while conventional combustion of one kilogram of coal produces just 8.1 kilowatt-hours. So uranium-235 contains almost 3 million times more energy per unit of weight than coal.

How could we help but make use of such a marvelous and vast power, discovered and mastered by human beings!

Atomic energy announced its appearance in the world with the roar and devastation of the Japanese cities of Hiroshima and Nagasaki by American atomic bombs and the deaths of hundreds of thousands of people. That is why many inhabitants of our planet receive statements about the power of atomic energy with fear and trembling.

But Soviet scientists, eliminating the U. S. monopoly on atomic weapons, thought about using atomic energy for peaceful purposes, for the good of humanity, not to harm it. It is worth noting that the appearance and development of Soviet atomic weapons has secured 40 years of peaceful, constructive labor for us.

The world's first atomic power plant appeared in 1954 near Moscow. Since that time atomic energy has begun spreading widely across the planet. AES's are in operation or under construction in 26 countries of the world today. At the present time, according to IAEA figures, there are up to 350 AES's (energy units) with a total electricity output of more than 250,000 millivolts (that is, 250 million kilovolts).

This is an enormous force. It is equivalent to the output of all the types and classes of power plants operating in England, France, and West Germany taken together. And these are the three countries that in fact define the image and industrial might of all Western Europe.

So the development of atomic energy should be considered an important line of action in the economies of particular countries and an essential factor in the contemporary world economy.

Atomic energy worldwide in 1981 was already producing as much energy (in oil equivalent) as all the oil wells of petroleum-rich Saudi Arabia. This is certainly a real illustration of the fact that atomic energy is capable of replacing such an expensive and scarce type of organic fuel as petroleum.

Taking account of its place in sea- and ocean-going transport vessels in the USSR in the form of the atomic icebreakers Lenin, Arktika, Sibir, and Rossiya and on submarines, but most importantly its use at atomic power plants to produce electrical energy, atomic energy has received broader application than any other types of its use in the national economy, science, biology, medicine, and other sectors.

More than 5,000 scientific, medical, and industrial organizations in our country use the most diverse sources of atomic radiation and radionuclides. Some of them are worth discussing from the standpoint of application, to make it clear how much atomic energy helps human beings conquer nature.

The analytic methods of nuclear physics are the best way to analyze ultrasmall quantities of impurities in substances and trace elements in geological and biological objects.

The enlistment of atomic energy in chemical production led to the appearance of a new area of activity -- radiation chemistry.

Soviet scientists have made a major contribution to world science by working out many important aspects of the theoretical foundations of radiation chemistry, including the theory of primary elementary processes; the mechanism of the formation and breakdown of free radicals in the process of irradiation; the mechanism of radiolysis of water and water solutions; the theory of energy transfer by molecular chains; and the theory and mechanism of ion-molecular radical and radical-ion reactions.

Development of heavy industry, metallurgy, machine building, ship building, and other industrial sectors demanded the use of steel ingots, heavy-gauge rolled sheet steel, large numbers of welded joints, and complex cast steel elements and raised the technical demands for the quality of welded joints and metals. This necessitated intensified and more rigorous control of parts made of steel and special alloys of differing thickness (400 millimeters and greater). This job is done very successfully today by the gamma-ray flaw detection method.

Our country was the first in the world to begin series production of Gamma-ray flaw detectors. We now have more than 4,000 gamma-ray detection devices of various kinds in operation. Special gamma-ray detectors have been widely used in the construction of trunk oil and gas pipelines and at enterprises of the ship building industry.

Radionuclide equipment is used to combat static electricity which occurs during production in many industrial sectors.

In a number of cases electrification (charging) has such a strong negative effect on the quality of products that it is a real disaster for production.

Radionuclide equipment is finding application at enterprises of machine building industry, in metalworking and casting shops, for interlocking aggregated machine tools and machinery, and on automatic lines monitoring and controlling industrial processes.

Medicine today has become a major user and grateful beneficiary of sources of atomic energy, above all radionuclides and ionizing emissions.

Radiation therapy is one of the primary ways of fighting malignant tumors. The development of radiation therapy techniques is linked to refining technical means for realizing them. Remote Gamma therapy equipment has the leading role in the technical equipment of radiological institutions.

After incorporation of industrial production of various radioactive nuclides and the development of numerous types of devices based on ionizing emissions the prospect appeared of using atomic energy not only for diagnosis but also for treatment of various illnesses, including malignant tumors. Roentgen-radiological methods of diagnosis and therapy were developed. Roentgenology, radio biology, and medical radiology became independent scientific disciplines.

In recent times medical Gamma equipment building has developed specialized equipment for treating specific locales. This equipment is designed to irradiate tumors located in certain body cavities, in particular gynecological, duodenal, and others.

Specialized Gamma therapy equipment is designated for the most diverse tasks, including irradiating tumors of the larynx, lymph glands, bones, and so on.

Soviet scientists, engineers, and doctors are working on radionuclide electrocardiostimulators. The fight against cardiac insufficiency has a large place in the work of specialized medical institutions. The essential point of the technique of electrocardiostimulation is that electrical pulses strike the heart muscles and cause the heart to contract at a rate equal to the rate of pulses arriving.

We have developed a large number of implanted electrocardiostimulators and introduced them in medical practice. The most widely used are the asynchronous electrocardiostimulators. They shape pulses that stimulate the ventricles of the heart and impose a fixed rate of contractions (60-70 pulses a minute) regardless of the frequency of contractions of the atria.

Many other examples could be given from the most varied fields of human activity. For example, we have not said anything about the use of atomic energy in agriculture, biology, and many other fields of human endeavor. But even the examples that have been given are sufficient to give an idea of the vast and diverse field of activity which atomic energy has developed. But it has received its greatest application in the development of electric energy.

If we consider the proportion of atomic energy on the scale of world electricity production, it is not that large. Only about 10 percent. But then, as stated above, at the present time only 26 countries of the 159 that belong to the United Nations, are operating atomic power plants.

The share of AES's in the Soviet Union is 10 percent. This is less than in many capitalist countries. But there is a very simple explanation for this. The USSR is rich in natural reserves of coal, petroleum, gas, and hydro resources; it is one of those industrially developed countries of the world which is completely self-sufficient in natural fuel and energy resources and can even export them. In conformity with outlined plans, our country is developing and will continue to develop atomic energy in the European part of the USSR, where 70 percent of the entire population lives. A decision has also been made to build an AES in the Georgian SSR.

In this sense our policy in the USSR is more correct and more logical. We are developing all forms of energy sources to produce electricity, except using petroleum at power plants. We are reducing its use and directing the petroleum to the petrochemical industry for processing.

There are more than 40 atomic energy generating units in operation in the USSR today. In 1984 they produced 145 billion kilowatt-hours; in 1985 it was 170 billion.

The primary types of energy reactors installed at AES's in the Soviet Union are water-moderated reactors under pressure -- water-moderated energy reactors, canal-type uranium-graphite reactors, and large canal-type boiling water reactors.

Our country also has three AES's with fast breeder reactors, and one of them (the one launched at the Beloyarskiy AES in 1980) has an electricity output of 600 megawatts.

As experience with incorporating the production and operation of AES's with fast breeder reactors is accumulated they will gradually be built into the power system and supplant thermal neutron reactors. The process of supplanting, of replacing slow neutron reactors will occur quite slowly in time. But this process is inevitable and, it would appear, will take place soon after the year 2000.

Nuclear power in our country, just as in the whole world, has very good prospects, particularly in those economic regions which have either inadequate natural reserves of mineral types of fuel and hydro energy or none at all.

Renewable energy sources such as solar, wind, geothermal, tidal, and others will develop, of course, especially in those places which have the appropriate conditions and possibilities. But their total contribution to the world energy system, at least before the year 2000, will be very small.

Thermonuclear energy has, I would say, bright prospects that excite the human imagination. Controlled thermonuclear fusion offers the prospect of providing the human race with an inexhaustible energy source whose primary fuel, deuterium, is abundant in nature. Today this is still a matter of laboratory research, which is being carried on in the USSR, the United States, England, France, Japan, and elsewhere. But the international INTOR group, which was formed in 1979 with the help of the IAEA and at the initiative of the USSR and includes as members the USSR, the United States, Japan, and a group of Western countries, was able to formulate a preliminary design of a thermonuclear reactor. While visiting France, and then later in Geneva, Comrade M. S. Gorbachev proposed to French President F. Mitterand and U. S. President R. Reagan that the countries become involved in further joint work on the INTOR reactor and through their combined efforts build a prototype of the thermonuclear reactor.

At the same time I consider it necessary to observe that the use of atomic energy to produce electricity often causes long and even bitter disputes because a certain part of the population think that AES's harm the environment. Many experiments and, ultimately, decades of operation by atomic power plants both in our country and in other countries of the world have clearly proven that this is not true. Everyone knows that any production activity involves a potential risk to human beings, society as a whole, and the environment. Therefore, this activity is possible only where the principle of obtaining a positive result with an acceptable risk is observed.

This applies entirely to the use of nuclear energy for peaceful purposes, including the operation of AES's. The danger associated with the use of atomic energy must be examined comprehensively: for people working in the particular sector, for the population, and for the environment.

The first subject has to be radiation, that is, the fact that AES's can harm the environment by their radioactive emissions because the atomic reactor is a source of radiation. At the same time, however, we should not forget that there are many sources of radiation around us, and they are very diverse.

The first source of radiation is our planet Earth. This radiation is explained by the fact that there are radioactive elements in the Earth whose concentration at various points fluctuates within a broad range.

The primary source of radiation is natural materials which human beings use to build residential and production buildings, giving no thought to radioactivity during their construction. But scientists have calculated that on the average the dosage of radioactivity inside buildings is 18 percent greater than outside; in other words, a human being living in a building is subjected to more radiation than when outside the building. But is this dangerous to a person? Of course not, because the level of this radiation is very low and does not cause a person harm. We should recall here that the International Commission on Protection against Radiation has recommended a safe dosage for a person of not more than 500 millirems a year.

Radiation has different values at different points on our planet. For example, at sea level the dosage of this radiation is about 30 millirems a year. As elevation above the surface of the Earth increases radioactivity also rises, and quite significantly.

Yes, atomic power plants are a source of radiation. They will gradually supplant thermal power plants operating on liquid fuel, gas, and hard coal. A trend toward broader use of hard coal to produce electricity has appeared in the world today. At the same time research shows that the overall danger from AES's is less than from coal-powered plants.

Research and practical experience show that in general atomic reactors at AES's are structures that possess a high level of safety.

The operating safety of AES's is ensured by a series of sealed barriers designed for all possible cases of AES functioning. The first barrier is the metallic shells of the nuclear fuel rods; the second barrier is the steel tank and pipeline of the first contour of heat take-off; and, the third barrier is the concrete shell of the primary contour.

Detailed studies have demonstrated that the possibility of a disaster at an AES is very slight. It is on the order of 1 chance in 1 million each year, which is incomparably less than the possibility of many other dangerous incidents that take place in various sectors of industry -- in production and transportation (air, rail, sea and ocean, highway and the like). We should not forget that in the age of the atom and space we have begun using atomic energy extensively in our everyday activities and, moreover, we do not intend to renounce it. Our public health agencies often receive complaints that the polyclinics and hospitals do not have enough Gamma therapy equipment. Thus, although it is common to use Gamma radiation therapy devices and radioactive isotopes in diagnosis and treatment, the population of our country receives significantly more radioactive exposure than from living near AES's. For example, with an x-ray of the lungs the patient receives an average of 100 millirems, while when the urinary tract is x-rayed the dosage is about 4,000 millirems. During a long flight on an airplane a person receives a dosage of 3-5 millirems. On the grounds of an atomic power plant the additional annual dosage is 1-5 millirems, while a few kilometers away it is close to zero.

Roentgenoscopy gives a person a person an average of 100 millirems, while television produces several millirems a year. Despite this, human life and activity continue without marked complications to health; on the contrary even, the length of human life is increasing.

All this illustrates that nuclear energy has received wide application in biology and medicine and serves human health, which is very important. It is the most reliable and realistic way to supply essential energy resources for the human race.

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NUCLEAR POWER

CONSTRUCTION PROBLEMS AT NUCLEAR POWER PLANTS

Delays at Kalinin Plant

Moscow STROITELNAYA GAZETA in Russian 28 Mar 86 p 1

[Article by V. Ovchinnikov: "Deadlines and Volumes"]

[Text] An alarming situation has developed in construction of the second power-generating unit--the "one-million," start-up of which should be in June of this year.

"Excessively large volumes of work must be completed. It is better to start up the power-generating unit later than the deadline and then it will operate reliably," the chief engineer of the AES [nuclear power plant] A. Mazalov characterized the situation.

The builders and installers are now working rather intensively. Soyuztsentratomenergostroy [All Union Construction of Atomic Power Stations], Minenergo SSSR [USSR Ministry of Power and Electrification], sent several installers and other specialists to the plant at the end of last year. The main installation organizations involved in the power-generating unit overfulfilled the January and February plan.

And still there was too much omitted last year.

But let us try to analyze everything in order.

The first and main question is equipment. Has everything been received?

"Practically everything," confidently answers the deputy director of the Kalinin Nuclear Power Plant for capital construction V. Ponomarev.

"There is still not enough support reinforcement," interject the brigade leaders of the installation teams, working in the reactor section.

Thus, brigade leader of the Udomlya MU [Installation Administration], Sevzapenergomontazh [Assembly of Power Systems of the Northwest and West] Ye. Malkov relates:

"Take a look, there should be five gate valves--complex, heavy, large units of special metal--in this pipeline assembly--each as thick as a good-sized log. Four of them were delivered long ago, but we have still not received the fifth one, and this occurred days ago and it was impossible to install a single one of them. There is exactly the same pattern with 'shaped' parts--cast parts for joining assemblies and pipes--pipe unions, tee-pieces and drains."

As we can see, it was early for V. Ponomarev to be calm. The following are not yet at the construction site:

fittings--more than 100 units;

equipment for the ORU-750;

shaped cast parts--more than 2 tons!

The teams of the Udomlya Installation Administration, Sevzapenergomontazh Trust, are headed by V. Moiseyev, V. Mayboroda, N. Shiryayev and T. Levchenkov, who prepared the turbine of the second power-generating unit to operate and to pump oil. Were the installers successful? Undoubtedly they were. But they are alos indignant:

"Like pirates, the operators during the night shift took the equipment sent to us for installation and used it to repair the first power-generating unit. Let us assume that these actions were justified by urgent need. But why was all this not reimbursed? And now we have prepared the oil-pump turbine ahead of schedule, but what is the use? There is nothing for it to pump, the client has the oil pump," says team leader A. Shiryayev. "Moreover, the operators are modifying the equipment after installation rather than before installation. You install and center a pump, they take everything away and then assemble it haphazardously, leave the centering to us, and sometimes many parts are missing."

"There is a lot of this confusion at the site," team leader A. Mikushin supports his colleague. "The pre-start procedures are underway, the hydrostatic tests are beginning in the machine room, but there is no drain system in the basement where we work and it fills with water. And it is also dark--there are only two-three lamps."

The chief engineer of the Gidroelektromontazh [Assembly of Hydraulic and Electric Power Systems] Administration A. Grushin expressed a similar complaint:

"Once we are required to prepare urgently the stator cooling pump for hydrostatic tests for operation. Our people worked all night and later it turned out that no one at all needed the pump."

The construction site has entered a period when plant personnel should be working alongside the installers. But there are not enough of them. There is also no coordination in the actions of neighboring workers. What does the contractor think about all of this? Here is the opinion of the deputy chief

of the construction administration of KAES [Kalinin Nuclear Power Plant] M. Rozenbaum:

"Yes, the deadlines are being tightened. It is time to begin hydrostatic tests and circulation flushing of the first circuit. To do this, 36 pipeline systems and equipment must be prepared for functional testing and far from all of them have been prepared. True, some equipment, especially electrical engineering equipment, remains to be installed. Hardly nothing has been done due to the absence of work by the heat installers. And we all do not share A. Mazalov's pessimism. The power-generating unit can be started up in June of this year and it should be."

There is experience of starting up exactly the same unit within 78 days from the beginning of hydrostatic tests and before inclusion in the network at the Southern Ukraine Nuclear Power Plant. But to transform possibility into reality, the Soyuzatomenergo All-Union Atomic Power Stations Association must send without delay operational and repair personnel of the operating service to the unit, where there is presently a shortage of more than 100 persons. And those very people must be sent who started up the unit in the Ukraine within 78 days.

To eliminate confusion, a plenipotentiary representative of the Ministry, who coordinates pre-starting procedures, is now required at the site. The director of the Kaliningrad Nuclear Power Plant, G. Shchapov, has turned over all matters related to construction of the second power-generating unit to Chief Engineer A. Mazalov. And we have already talked about his position at the very beginning of this article.

It is stated in the resolution of the 27th CPSU Congress with respect to the Political Report to the CPSU Central committee: "Modern management requires rearrangement of thinking and rejection of established stereotypes." Based on these requirements, it is obvious that the director of the Kaliningrad Nuclear Power Plant G. Shchapov and the chief of VPO [All-Union Production Association] Soyuzatomenergo, G. Veretennikov, should also solve the current problems of the construction site.

Criticism of Crimean AES Director

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Apr 86 p 2

[Article by N. Pashin]

[Text] The letter was alarming. It was about how construction of the Crimean Nuclear Power Plant is limping along, as they say, on both legs, but its managers have actually resigned themselves to this. "It is time to stop deceiving ourselves and to stop enjoying imaginary well-being. We must look the truth in the eye"--these are the lines from the letter. And its author, deputy director of the power plant under construction for personnel A. Kovalenko took approximately the same tone at an election meeting.

The 14th committee, according to the official count, is now engaged in researching his personality. The first committee began to look for negative aspects of his biography immediately after the meeting.

What was the reason for such close scrutiny of a communist? It turns out that 100 persons voted against the secretary of the party committee of the power plant, V. Kurennoy--every fourth communist--at this meeting; the communists openly refused to elect the chief of the construction administration, Ya. Grigoryan, to the party committee, thus expressing complete distrust of the manager of the construction project. And both these facts are now linked to the actions of A. Kovalenko.

"Here was clear collusion of those who do not like to work, but like to criticize others," Viktor Nikolayevich Kurennoy said sharply, as if wishing to end the matter right there.

"They gathered together malcontents, people bearing some kind of grudge, and they voted against," Yakov Abramovich Grigoryan explained.

"Who gathered together?"

"We know who. Representatives of the client."

This is how the managers of the construction project--party and economic managers--evaluate the matter. But what do they think about the conflict in the Leninist regional party committee?

"Nothing foretold such a turn of events," the first secretary of the regional comittee V. Belik said to me. "The results of the vote, and it lasted for several hours, was a surprise to many. It was even unpleasant."

Alas, we feel that an attempt is seen in these words to make wishful thinking a reality, since in this case we are talking about completely regular "chance." Many of those who are involved in one way or another with the Crimean Nuclear Power Plant agree with the opinion: the construction project has dragged on excessively long; many of its problems arise more quickly than they are resolved or rather more quickly than forces and possibilities are found for solving them.

Moreover, there are also objective reasons. But there are incomparably many subjective reasons. One should begin with the fact that the present manager of the Crimean Nuclear Power Plant is already the third by count. And his predecessors cared not so much about affairs at the construction site as about personal comfort for themselves and for their elected subordinates. People saw this and unwillingly stopped believing the fiery words that all difficulties with services and housing in the settlement of energy builders of Shchelkino are temporary and that one must patiently wait for one's turn. And this turn for some reason never came for many, since the new manager began in the same manner.

Possibly, this would not be worth mentioning, but here are the recent facts: the director of the nuclear power plant under construction, O. Dmiterko, was

reprimanded by the party for "personal indiscretion in distribution of housing" and the party committee secretary, V. Kurennoy, was reprimanded for the fact that he looked through his fingers at similar facts.

No strong, healthy collective was established at the construction project from the very beginning. Some random people arrive, others are sent to different regions. It is sufficient to say that 1,400 of 1,500 workers and employees who arrived last year have been released. The same ones who completely settled in at Shchelkino were forced in one way or another to encounter a number of these daily problems, the existence itself of which one cannot explain by "outside" factors. And as a result, there is dissatisfaction of people growing from day to day.

Added to this are purely production deficiencies: weak organization of labor, endless forced idle times of construction teams, and low-level engineering preparation. As a result, only half the plan of construction-installation work was fulfilled last year, while the builders began this year even worse: the January and February plan was fulfilled by 30 and 48 percent, respectively. A services building, pharmacy, first-aid station, cleaning facilities, fire station and several dormitories were thus not constructed at Shchelkino, although they were supposed to become operational according to the plan 2 years ago. Thus, they were promised to people in any case.

And yet another thing must be said. We must talk about the interrelationships between the two hosts of the construction project--the client and contractor. Many with whom we talked at the Crimean Nuclear Power Plant characterize them this way: "The directors have an allergy to the builders and the builders have an allergy to the directors. They do not perceive each other. And the party committee, although it is said to be united, is incapable of reconciling them."

It was simply impossible not to see in all this the grounds for a direct, principle and impartial conversation about the fate of the counstruction project. And the party committee, judging by everything, saw these grounds. But a conversation with the tribunal of the election meeting was mainly about the fact of what had been done and seemed to read between the lines about existing individual deficiencies.

The deputy director for personnel, A. Kovalenko, spoke on this "background." He generally talked about what was already well known to many, and the figures are no secret. The inspiration of his speech reduced to the following: if the party committee does not rearrange the style of its work and of its relationships with the collective, then the construction project will be ruined completely.

Of course, all the foregoing could not immediately arouse communists against Kurennoy and Grigoryan. This speech only played the role of a detonator, which activated the explosion of distrust against the secretary and chief of the construction project. In the end, a person adds all the pluses and minuses of real life, as was said at the 27th CPSU Congress, to the figure of party management and to his personal and business qualities. And the

communists gave their grade to these qualities. What is the surprise here? Where is the "collusion?"

It would seem that the party committee of the construction project and the party regional committee, after all that has happened, should immediately analyze what communist Kovalenko said. But is there truly not the strength of a better tradition: to analyze the person himself. Who is this Kovalenko, really? How and from where did he appear in the Crimea? Does he not have past sins? "Public opinion"--understandably, far from the best--began to form immediately around the "truth-seeker."

Anonymous letters against Kovalenko, which were sent to various local departments, were yet another occasion for this. The Crimean party regional committee and the Leninist regional committee, the oblast financial department, the oblast bank, militia, oblast committee of people's control, oblast trade-union committee and Association Krymenergo quickly verified them. Instructor of the Crimean Oblast Party Committee Ye. Denisenko personally made the rounds of teachers of the settlement kindergartens and asked them questions, with the contents of which a wide reading audience was not acquainted.

We admit completely that communist Kovalenko, as is said, is no angel, and that he has some deficiencies in his work. But we note that the primary party organization during its analysis gave him a quite positive characteristic. Is it that the regional committee and even the oblast party committee do not trust the opinion of communists over the local committee?

Incidentally, other questions as well arise. If an unworthy person comes out directly with objective criticism, then why do communists who have nothing to reproach in anthing, remain silent? And how do people now ascertain that both the anonymous letters and the checks begun after the meeting are only random coincidences and not an attempt to deal with a person for criticism? And this is what very very many in the settlement think.

Yes, the skill to extract valuable lessons from critical comments rather than to defend oneself against them with all accessible (and even inaccessible) means should be inherent in each manager--both party and economic. It should become one of the main components of the style and methods of their work with people and with the collective. We agree that this is not a simple art, primarily requiring conviction of the reightness and validity of one's actions and one's position. If this is not true, then the desire" to go rummaging into the personality of the one who appears with the criticism inevitably occurs. And sometimes it is not even from a feeling of vengeance or from a desire to settle personal accounts with a person or to teach him a lesson for the future, but again to find a reliable defense: but then, who is the judge?

Is he reliable? No, it only seems so. Because the most valid and most reliable and effective response to criticism remains the desire to correct deficiencies and to open the way to a healthy, leading attitude. Unfortunately, those who resorted to the personal matter of communist Kovalenko rather than the "private matter" of a construction project tormented by many deficiencies did not understand this.

"It should be admitted," agreed the secretary of the Crimean Oblast Party Committee V. Pigarev, "that the party organization of the construction project lacks real combativeness and this is true primarily of the secretary of the party committee. Another thing is also clear: the Leninist regional committee was unable to evaluate in time and correctly the situation in the collective and to assist Kurennoy to occupy a valid position here."

I listened to the secretary of the oblast party committee and thought: it is of course good that they understand this in the oblast committee. But, from recognition of deficiencies and omissions in their work, a real, specific step must be taken to see that they do not occur again over time. This is even more important, since introduction of the capacities of the Crimean Nuclear Power Plant is envisioned by the Basic Directions for the Economic and Social Development of the Country. The collective of the construction project must solve very serious tasks--to assimilate 60 million rubles of capital investments this year and to start the first power-generating unit next year.

And it is felt, in voting at the election meeting against V. Kurennoy and Ya. Grigoryan, that the communists have thus expressed severe doubts that they will be able to bring the construction project successfully to these important positions.

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CONSTRUCTION PROBLEMS AT CRIMEAN AES

Moscow STROITELNAYA GAZETA in Russian 4 Apr 86 p 2

[Article by Correspondent M. Stoykevich: "A Special Flight for a Scolding"]

[Text] Shchelkino Village, Krymskaya Oblast --

> Due to unfavorable weather, a special Aeroflot flight with guests from Moscow was late in landing at Simferopol. Having been met there and delivered in a line of limousines, shined up and glowing like mirrors, they went from one project to another, stopping at some for a "visual acquaintance."
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> "The fact of presence", as they say, was there. Nevertheless in these few minutes they could hardly have conducted any business, let alone make any valid conclusions on which to base the necessary decisions. But no matter how fast they moved, no matter how fast the automobiles accelerated, at the monthly "operational meeting" which is conducted at the construction site of the Crimean AES, the participants in the so-called "drive around" were late. And the Chief of Soyuzatomenergostroy [the Nuclear Power Plant Construction Association] of the USSR Minenergo [the Ministry of Power and Electrification], M. Tsvirko and the other specialists of this VSMO [unknown, possibly All-Union Ministry] did not decide to visit them for nothing.

The building of the Crimean AES, which was begun nine years ago, is going very slowly. Out of almost 200 projects of the construction base and of industrial designation, not a single one has been completed. Some 75 million rubles is "frozen" there in incomplete production. In the complex for the first power unit, which was supposed to have been handed over in the fourth quarter of next year, by the beginning of this year there had been completed just over 40 percent by volume of construction and installation work. The tasks of the last two months were only 65 percent completed.

The first and the main reason for this situation, according to a statement at the operations meeting by the Chief of Construction at the Crimean AES, Ya. Grigoryan, is a shortage of people. Nevertheless the matter of cadres did not get any attention at the meeting of the leadership and the Chief of Soyuzatomenergostroy M. Tsvirko.

Can it be that social and everyday matters are that well solved at the Crimean AES?

If a miracle were to take place and there were to be assigned two thousand men to the structure -- men that according to the bosses are desperately needed-- where would they live? There are not enough places in dormitories, let alone accommodations for small families. The waiting list for improvement of living quarters contains more than one thousand families. Add to this more than 800 more numbers in line for a place in preschool, and the one and one-half times overload of the only middle school in the village (only the foundation is laid for the second school), and the limited schedule for supplying water to housing, and two hundred places for the single club serving 15 thousand population, the low level of medical service, the poor organization of passenger bus service -- and it becomes clear why the structure has become a revolving door. Last year alone, in the construction directorate of the AES alone, 1,140 persons were hired, and 1,263 were released.

Nevertheless the wayout of this situation was stated by many participants in the pre-Congress documents, and there were concrete proposals sent to the USSR Minister of Power and Electrification A. Mayorets through a delegate to the 27th Party Congress, the plasterer A. Tarusha. There is talk that it is essential to obtain confirmation not only for the first period of construction of the AES, until delivers of the first power unit, but also the status of service housing for the workers on the structure. If you work, you will get an apartment and will live in it in health, but if you quit, you will use it. This is all understandable considering the conditions and their reasons. Such a step is made easy by the autonomy of the villages for nuclear power station construction sites, their remoteness from other settled points. But just like with other of the urgent social problems, this matter was not only avoided at the meeting, but it was not even brought up. The Chief of Soyuzatomenergostroy was interested in only one thing, "How much will you deliver during March?" When one of the supervisors, soberly evaluating his capabilities, answered, looking the truth in the eye, that in March they would barely make the plan,but already in April there were making up for slippage, the Deputy Minister for Power and Electrification of the UkSSR, A. Gritsenko, gruffly cut him off, saying, "get off the platform unless you have the figures." In other words, the bosses were predisposed to listen to only those figures which they wanted to hear.

Thus the introductory meeting fell to the level of a regular scolding, with deprecatory name-calling of those who are lower on the ladder of the service hierarchy, who were "bending" the plan. Promise unrealistically to complete, and you will be riding high until the 11th of the following month. And while for the course of this period you will look like a naked king, when you make new promises, you will again be made a hero. Just such tactics are being continued, for example, as the wisened-by-experience chief of the construction directorate, M. Krasikov, who in the minutes of not less than a tenth of the monthly meetings is obligated to get the fire depo working, and the chief of Soyuzenergozhilstroy Directorate No 4, A. Mikulin, promising from meeting to meeting to complete the severely lagging building of the municipal services combine, and many others.

In general, there were so many "thematic" matters addressed by the representatives to the meeting, such as the construction of the breastworks for the

drugstore or the freeing of one of the sites from the pre-cast ferroconcrete which was on it and such "problems", that they were silent about the main one- - the fact that such attention was paid at the 27th Party Congress to the "human factor", about social structures, the non-regulation of which dooms it to ever growing breakdowns.

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NUCLEAR POWER

BRIEFS

NEW STYLE TURBINES FOR SOUTH UKRAINSKAYA AND CRIMEAN AES -- Leningrad --At the "Leningradskiy Metal Plant" Association work is going on at full speed in preparing units for the South-Ukrainskaya and Crimean AES. These turbines will differ significantly from their predecessors -- they contain less metal and are less labor intensive. The new type, for example, will be 320 tons lighter. "Decreasing the labor and material resources during manufacture of these "millionaires", we are considering our prospective tasks," says the Chief Designer of Steam Turbines for the Association O. D. Volkov. "The corresponding preliminary work has already been done, as is shown by the readiness of the new production to do this. And all the same our main task for today is to make a unit with 800 thousand kiloWatt capacity." What is this, a step backward? There has been larger equipment installed. "No," says O. D. Volkov. "The new units with 800 thousand kiloWatt capacity are more economical that the "millionaires", since they are set up so that higher pressure and steam temperature is used in the turbine. Furthermore, using such equipment in the unit with the fast-neutron reactor allows us to cross over to essentially waste-free technology in using the nuclear heat. There are also other attainments in this. Speaking as a whole, the economic effect of adopting the new equipment for the AES will amount to tens of millions of rubles. [by A. Aleksandrov] [Text][Kiev PRAVDA UKRAINY 16 Mar 86 p 1] 9016

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NON-NUCLEAR POWER

STATUS OF POWER PLANT CONSTRUCTION IN WEST SIBERIA

Moscow STROITELNAYA GAZETA in Russian 6 Apr 86 p 1

[Article by A. Zhdanov, Tyumen Oblast: "A Reliable Supply of Energy to the Tyumen North"]

[Text] Tyumen power industry builders are now constructing five powerful electrical power plants and are beginning a sixth. A particular role in meeting the northern petroleum and natural gas mining regions growing demand for power has been played by three of them, the Surgut State Regional Power Plant [GRES] 2 and the Nizhnevartovsk and Urengoy GRES.

The Urengoy GRES

Its basic facilities include generators, two construction bases, reserve central heating and power plant and a worker settlement. The first generating unit should go on line in 1989. The January-March plan has been 69.6 percent fulfilled.

The first "landing" by the power plant builders occurred in 1982 here on the shore of a lake with the difficult name of Yamylimuyaganto which lies only 50 kilometers from the Arctic Circle. What has been done there recently?

In the opinion of the construction bureau's director, A. Anisimovets:

"The formation of the starting production base is almost finished. Our supply depot is at at Korotchayevo, the nearest station, but we will soon have a railroad line coming up to the construction site.

"A temporary housing settlement for 1000 workers has been finished and it includes a cafeteria, bank and other public facilities.

"All of this is good but out of the 20.6 million rubles worth of work that we were supposed to do in 1985, about four million has gone unrealized and the first quarter's plan has been ruined.

"The Gidrospetsstroy Association and Gidromontazh Trust are not doing their job well. We must see much improvement in the work of one section of the Transgidroenergomekhanizatsiya Trust whose earth-moving equipment operated only an average of 13 days last season. That has left us one million cubic meters behind in our hydraulic filling. It is really up to the manufacturers of our hydraulic machinery as to whether or not we can properly build the plant's foundations which is our goal for 1986.

"We lack the proper number of bulldozers, tower cranes and dump trucks to meet our nearly-doubled plan for this year. Our needs for structure for unified knock-down buildings, pilings and many other items come far from being met and we do not receive any prefabricated buildings at all.

"If we are to increase our work force (by the middle of the year, we will need 2000 workers) on time, we will have to put up at least 15,000 square meters of housing. But instead of the needed 7200 square meters of wooden living space, we have been provided with only 5800. In place of the 7500 square meters of large-panel houses that we need, Minenergo's Volga plant only promises to provide 6000. Aside from that, Kamgesenergostroy, which was ordered by Minenergo to build 180,000 square meters of housing at the Urengoy GRES, has been completely passive".

Along with A. Anisimovets and O. Pryadilshchikov, the director of the plant under construction, I visited an experimental site for electrical thawing of permafrost and it is this electrical thawing followed by the filling in of the stabilized sections that the general contractor, the Urals Division of the USSR Coal Ministry's Pechora Scientific Research Institute in Vorkuta proposes to ensure the reliability of the GRES and its settlement. The directors of the construction bureau and the plant itself also feel that this solution is a good one. However, the Leningrad Communal Construction Science, Research and Design Institute (which designed the settlement) proposes the sudden thawing of all of plant grounds including the settlement.

"So these costs for electrical thawing and filling have now reached an astronomic sum and the settlement will not be ready before the start of the next century," said O. Pryadilshchikov.

The Nizhnevartovsk GRES

> Its basic facilities include the generating units, a construction base and housing settlement. The first generator is supposed to go on line in 1988. This plant is being built on soil hydraulic-filled by the stint method. The January-March plan has been 108.2 percent fulfilled.

I will begin by saying that according to the data provided by the Samotlorsk division of the USSR Construction Bank [Stroybank], over a period of three years, less than one-tenth of the costs of the start-up complex have been assimilated and the level of first degree technical readiness last year was 0.23 percent. To start the first unit, it will be necessary to assimilate 1,500,000 rubles just for the industrial facilities.

"Could we have expected anything else while the plant's design plans and technical and economic justification have still not been approved in their final form?" said Stroybank's Division Director L. Sokolov and Plant Director V. Zhabo.

A documentray film with the catchy title of "Dawn of Diligence" was shown in a local television broadcast. Afterwards, one could have witnessed the following scenes in the GRES construction bureau in 1984-1985: the directors' offices were literally attacked by crews demanding work. The situation was a very unusual one for a new construction site: more than enough workers and not enough to do. Therefore, half of the 2700 workers hired within a short period of time were sent to other regions of the oblast and country.

This could lead to no good. For two years in a row, the worker turnover was more than 90 percent. In 1985, gross violations were discovered in the quality of the work and these drew extreme sanctions from Stroybank and led to the replacement of the director.

"We are now fulfilling our plan but we must still sharply increase the amount of our hydraulic filling and the pace of work in the construction of the facilities for the production base," said the acting chief engineer of the construction bureau, A. Skrylev. "This year we must assimilate 70 million rubles which is more than twice as mich as we could do in 1985. At the same time, our prospecting work is far from finished and as before, there is an enormous amount of doubt about the technical documentation. The Urals and Tomsk Divisions of the Atomteploelektroproyekt Institute, the Krasnodar Division of the National Science Research Institute of Hydrotechnology imeni Bedeneyev and TyumenTISIZ [not further identified] are demanding that we work as fast as possible."

There still remains the extremely critical problem of transportation. The construction site needs direct road communications with Nizhnevartovsk as well as a railway branch line, not to mention more housing. What the site now has is 6 times less than what it needs. The builders very much hope that the Soyuzzapsibenergostroy and Minenergo will keep their word to provide all that has been promised.

The Surgut GRES-2

> Two of its 6 generating units have already been started up and the third is scheduled for May 1986. The January-March plan has been 113.9 percent fulfilled.

The builders of the Surgut plant have a good, solid reputation. The best proof of this is the pace of work achieved in the construction of the two generating units here. With a normal completion time of 43 months, the first was finished after only 25 while the second took 15 and 9 months respectively. Our country has never before seen such fast work in the construction of plants like this one.

The workers of the general contractor, the Zapsibenergostroy Trust, and its partner organizations have completely mastered the method of reinforced assembly of structures and introduced many innovations to their work technology, learning, for example, to do the once-impossible task of producing good welds for exterior pipelines at low temperatures.

In other words, these workers did not borrow their experience and innovative traditions. That is why they, striving to actively assist Tyumen oil fields to overcome slowdowns in their work, have accepted the task of starting up unit 3 in 8 months which is one-third of the normal time for completion of this work.

Naturally, it was necessary to re-examine the supply schedule and this was reflected in the measures taken by Minenergo USSR. The construction workers themselves called upon factory workers to join a "worker relay" and hasten the provision of parts for the third unit. Not limiting themselves to that, in autumn of last year Zapsibenergostroy formed a few groups from among the leading workers, communists and union activists to visit the plants supplying the construction job and the local party organs.

The proposed shortened provision schedules were sustained by the workers of the Leningrad Elektrosila Plant and several other organizations. However, the Surgut workers are also disappointed by many others. For example, Minenergomash's Belgorod Power-Generating Machinery Plant and Minenergo's Zuyev Power-Generating Machinery Plant are among the disappointing partners. In February of last year, it became necessary to call on the help of the air force to deliver lots of connector parts on time. About four tons of bolts and washers from Minenergo's Novosibirsk Metal Structures Plant turned out to be useless. Finally, it had to be admitted that the "worker relay" had come to nothing.

As before, the plant builders are suffering from an acute shortage of good housing. It is enough to say that the waiting time for an apartment and child day care has not only not decreased but actually grown. About 3500 employees of the general contractor, Zapsibelektrostroy, alone are waiting for quarters along with every third trust employee. The opening of the "Energetik" cultural center has been postponed more than once.

Minenergo USSR's promises to hasten the construction of housing and public facilities have gone unfulfilled and this was pointed out by N. Anikin, first secretary of the Surgut City CPSU Committee in his speech to the 27th CPSU Congress. It is interesting to note that this is the only ministry in 1985 that failed to meet its housing construction plan. Not long ago, the Zapsibenergozhilstroy Trust was founded in Surgut with a plant capable of building 75,000 square meters of living space. However, the plant is only very slowly reaching its full potential.

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NON-NUCLEAR POWER

DEVELOPMENTS IN LEP, UHV CONSTRUCTION

New East-West Power Line

Moscow PRAVDA in Russian 11 Apr 86 p 3

[Text] PRAVDA was notified by Minister of Energy and Electrification A. Mayorets that the USSR Ministry of Energy feels that the article "Siberia-Center Energy Bridge" published in the 5 February issue of PRAVDA properly presents the need for construction of the Ekibastuz-Center 1500-kW direct current electrical power line during the 12th Five-Year Period.

Once this line begins operating, the excess power generated by nuclear power plants built in the European part of the USSR can be transmitted at night to the East to relieve some of the load on Siberian electrical power plants. This will make it possible for the Siberian plants to generate extra power during daytime hours and reduce the load on thermal electrical power plants. Calculations have shown that this will reduce the consumption of natural gas and fuel oil by three million tons.

Construction of this line will greatly increase the electric transmission capacity between the European and Asiatic parts of the USSR's Unified Energy System [UES], that is, it will significantly raise the maneuverability of the UES.

Minenergo USSR is taking the necessary measures to step up work on the construction of the electrical power line which is expected to go into operation in 1989 and reach its full capacity in 1991.

New Electrical Power Line

Moscow IZVESTIYA in Russian 19 Feb 86 p 1

> [Text] A unique two-circuit 500-volt electrical power line is being built which will allow all of the energy generated by the Balakova Nuclear Power Plant to be sent to the USSR United Power System.

The red flag hung nearly in the clouds at the top of a very high 200 meter line support symbolized a victory on the very eve of the 27th CPSU Congress by the employees of the Volga division of the Yuzhelektrosetstroy Power Line Construction Trust.

Crossing a shipping canal and the Volga, the builders extended under extremely tight schedules a reliable energy bridge between the Volga region's first nuclear power plant and a series of substations. The last stage of construction was especially complicated because the work had to be done at enormous heights in severe frosts and strong winds. But working steadfastly to overcome all difficulties, the builders seemed to compress the time given them to complete the job. For example, nearly two months were needed to string the lines but this serious and laborious job was completed in only twelve days.

Safety Clothing for LEP Repair Work

Moscow IZVESTIYA in Russian 16 Mar 86 p 1

[Article by L. Kaybysheva, Podmoskovye: "Along Mighty Electrical Power Lines"]

> [Text] The image might seem commonplace: a man puts on an orange jacket and pants, gloves, high over-shoes and a helmet and climbs up an electrical power line support to do some repair work. However, what is unusual here is that the line is carrying more than one million volts of electrical power!

The new protective clothing for line repair personnel has been successfully tested at the experimental substation at Bely Rast. Repairmen were raised in a crane, clung to the wires with a bar and then walked along them, giving the impression that millions of volts was nothing more than child's play.

The special clothing with its undergarments made of calico fiber weighs no more than two kilograms. It is given its protective qualities by a special rayon KEN fiber. The conductive fibers allow the electrical current to flow around the body and lets the repairman work without experiencing any electrical shock.

Soviet power industry workers are already experienced at working on electrical power lines under 330,000 and 750,000 volts. A center has been created at which repairmen take special training and use different technologies for work under unusual conditions. Since the successful experiments at Bely Rast, super-high voltage has now been added to the training program.

It has been estimated that performance of repair work done under voltage saves more than a million rubles per year because it does not interrupt power transmission over the lines being serviced.

The advantages of this new technique are obvious but how does it affect the health of the people who must work under such high voltages? Every step has been taken to protect their health and safety.

The safety clothing is very comfortable and reliable and the House of Special Work Clothing in Moscow has now produced the first lot of these garments and is prepared to make as many as are needed. EVen the production of the KEN fabric presents no special problems except for the fact that about 10 tons of

this fiber are needed each year to meet the present level of its demand by Minenergo USSR. The directors of the experimental plant producing the fabric feel that they cannot comfortably mass produce such a small quantity.

Perhaps it might be feasible to make production of this fiber profitable enough to interest the chemical industry in producing such small lots of the material. This would have a beneficial effect on our national economy in general and make work easier and safer for people to perform. After all, that is the end goal of all scientific and technical progress.

New Siberian Power Line

Moscow EKONOMICHESKAYA GAZETA in Russian No 15, Apr 86 p 6

[Article by M. Nikiforov, Chita Oblast: "The Energy Bridge Is Moving Forward"]

[Text] The Skovorodino-Mogocha 220-volt power line crosses the taiga and rock scree where no roads are found.

The line is being built very quickly. The normal construction time for a project of this sort is three years but in view of the importance of this particular line, the employees of the Vostoksibelektrosetstroy ELectrical Power Line Construction Trust have taken on the responsibility of completing the job in one year.

This energy bridge will carry power generated at the Neryungri State Regional Electrical Power Plant and the Zeysky State Electrical Power Plant into the Chita Transbaykal region and therefore link the power systems of Siberia and the Soviet Far East. The additional energy will make it possible to further develop the economy of a large and richly-endowed region and bring power to the last remaining unelectrified stretches of track along the Trans-Siberian railway.

Within days, the builders together with employees of the Transbaykal railway, the Udokan Geological Prospecting Expedition and various timber and mining establishments completed the preparation of a 325-kilometer long right-of-way for the line.

A "worker's relay" competition was organized. Additional responsibilities have been accepted by the employees of the plants manufacturing metal and ferrconcrete structures for the line. Progressive forms and methods of labor organization are to be used in this project along with bold technical and technological designs.

The line builders have expanded their subdivisions along the route, are bring materials and structures to remote places without losing time and are getting ready to construct the line.

Completion of International Power Line

Moscow EKONOMICHESKAYA GAZETA in Russian No 15, Apr 86 p 3

[Text] The main section of a 750-kV electrical power line running 400 kilometers to the western border of the USSR is now operating. This line joins connects the Yuzhno-Ukrainskaya [Southern Ukraine] Nuclear Power Plant with Bulgaria's power system. The construction of this international power bridge in Soviet territory has been fully completed.

Skorovodino-Mogocha Power Line

Moscow STROITELNAYA GAZETA in Russian 4 Apr 1986 p 3

[Article by A. Prigodoch:"The Skorovodino-Mogocha Power Bridge"]

[Text] On a broad front stretching from Skovcrodino in Amur Oblast to Mogocha in Chita Oblast, work has begun to build a 220-kV electrical power line to connect the Siberian and Far Eastern Power Systems. This line will carry electricity form the Zeysky State Electrical Power Plant and the Neryungi State Regional Power Plant to the Transbaykal region.

All along the line's route, support points are being built for the builders. Along existing all-season roads, materials and structures are being brought into the most remote places where they will have to be stockpiled for the spring thaws. By the beginning of April, the right-of-way for the entire 332.5 kilometer length of the line route will already have been cut through the efforts a many different organizations in both oblasts.

The employees of the Vostoksibelektrosetstroy Trust which has been ordered to build the Skovorodino -Mogocha line have taken upon themselves the duty of finishing this project in one-third of the normal work time so that the line can go into operation by the end of this year.

New Power Line in Caucasus

Moscow EKONOMICHESKAYA GAZETA in Russian No 19, May 86 p 3

[Text] A continuous supply of energy is now being transmitted on the high-altitude Ezin-Kazbegi electrical power line in the mountains of the Northern Caucasus. The new line connects a hydroelectric plant on the Terek River in Northern Osetia with the distant Kazbegi Rayon in Georgia.

Construction of Power Line in Western Siberia

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 28 Mar 86 p 2

[Text] Aleksander Sutachev's crew from mechanized column number 14 of the Zapsibelektrosetstroy Power Line Construction Trust is conducting shock work to build the latest 500-kV electrical power line which will carry electrical power hundreds of kilometers from the Surgut State Regional Power Plant to oil

fields. This elite group is erecting multi-ton 40-meter high line supports and hanging wire in the northern tundra and the swamps of the Khanty-Mansiysky Autonomous Okrug. A high level of discipline, many years of experience and love of their work help A. Sutachev and his workers to construct an electrical power line ahead of schedule under these difficult conditions.

Reserve Power Lines in Ukraine

Moscow STROITELNAYA GAZETA in Russian 19 Feb 86 p 3

[Text] The reliability of the electrical supply to large agricultural establishments in the Odessa, Nikolayev and Kherson Oblasts is being improved by specialists from Odessaenergo Association. They have completed the creation in this region of a reserve electrical power supply system.

Previously, livestock complexes, processing plants and other facilities suffered work losses from interruptions in their power supply. For example, the shutdown of electrical equipment only during the evening milking at a farm with a thousand cows caused a shortage of 3000 kilograms of milk.

These farms are now surrounded by a ring of two-line substations. If the existing power line goes out of order, its load is automatically taken over by the reserve lines which are switched on by special relay equipment.

Line Supports for Water Barriers

Moscow SOTSIALISTCHESKAYA INDUSTRIYA in Russian 12 Mar 86 p 1

[Article by V. Lifanov, special correspondent, Balakovo: "Crossing Water Barriers"]

[Text] A unique two-circuit 500-kV electrical power line connecting the local nuclear power plant with substations has gone into operation in Balakovo. To have the line cross two large water barriers, a shipping canal and reservoir, the builders from the Gidromontazh Trust have found that they must erect steel line supports as high as 200 meters. High-altitude steel workers from the Yuzhelektrosetstroy have been toiling around the clock to put up these supports.

Old Hydroelectric Plant Still in Service

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 25 Mar 86 p 2

[Article by A. Vorobyev, special correspondent, Kuybyshev: "A Little State Electrical Power Plant"]

[Text] About 60 years ago when the remarkable GOELRO [not further identified] plan was being carried out, the Volga region's first hydroelectric plant was built on the Syzranka, a tiny tributary of the Volga. Its rated output seemed proud for the times: 2000 kilowatts.

The plant has always done a good job. It especially helped the city of Kuybyshev during the hard war years by providing power for its factories and homes.

The turbines made by workers from Saint Petersburg are still turning. But what does 2000 kilowatts mean in comparison to the millions generated by the Volga State Electrical Power Plant imeni Lenin and the new central thermal and electrical power plants?

However, the little plant on the Syzranka is not thinking of being retired. The Syzran Turbine Factory is getting ready to produce a series of small hydroturbines for power plants on small rivers and this modest little plant will be used to test the new equipment.

International USSR-Romania Electrical Power Line

Moscow PRAVDA in Russian 16 Mar 86 p 1

[Article by V. Vasilets, Soviet-Rumanian border: "'Crane' Over the Danube"]

[Excerpt] As they say, the "crane" has become fledged and ready to take up with its beak the steel thread that will hang over the kilometer-wide smooth surface of the Danube and cross the border to connect the international 750-kV electrical power line. A river of energy will cut across the water artery to carry power from the Yuzhno-Ukrainskaya Nuclear Power Plant to the Romanian substation at Isakca and then to the Dobrudja region of Bulgaria.

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NON-NUCLEAR POWER

SUPPLEMENTARY POWER SOURCES FOR RURAL AREAS EXAMINED

Moscow EKONOMICHESKAYA GAZETA in Russian No 5, Jan 86 p 9

[Article by Y. Grigorev, Director of "Lengidroproekt" and M. Syroezhin, Candidate of Technological Sciences: "A Reliable Supply of Energy for Rural Areas"]

[Text] The main method of electrification in rural areas up to now has been connecting feed and distribution networks--through substations to large power sources or high voltage lines. As a result, there are now 4 million kilometers of supply lines. This "necklace" could be strung around the world 100 times. However, according to USSR Minenergo [Ministry of Power and Electrification] approximately 280,000 kilometers of these feed lines are in unsatisfactory condition.

In other words, all it would take is some sort of emergency (hurricane, ice-covered ground, snowstorm) to cause an outage for a number of electrical energy consumers and significant losses to the grain, livestock and poultry industries.

Some specialists consider it useful to plan for reserve diesel power stations of a 500 kilowatt capacity, produced by the Leningraders for the BAM. Others see the solution in building auxiliary--parallel transmission lines.

In our view, the rational path is set out in the Energy Program: use of self-renewable resources, particularly small-river hydroelectric power. After all, our country has 150,000 small rivers ranging from 10 to 100 kilometers in length. Which means tens of thousands of small GESes and microGESes.

These GESes should be simple, but perfected and adapted for automatic operation. This would set them significantly apart from their predecessors, running in the 1940's and 1950's at high operating costs.

Mass construction of small GESes in the USSR would allow for harnessing of the significant potential of yet untapped but usable energy resources. It would meet a portion of the most important challenges of resource conservation: fuel conservation in thermal power plants and especially in small diesel power plants, in wide application only in the North, the Far East and high mountainous areas of the country.

Construction of small GESes will be of particular significance in supplying a reliable source of power to rural areas and in sharply reducing present "outages" to the consumer. It will allow the All-State indicator of economic efficiency for small GESes, which no one is considering at present, to rise.

To sum up, we consider it necessary to add the following resolution to the draft on Basic Directions: "TO CONCLUDE PREPARATORY WORK FOR MASS CONSTRUCTION OF GESes IN SMALL RIVERS AND TO UNDERTAKE SERIES MANUFACTURING OF EQUIPMENT AND CONSTRUCTION OF THE FIRST AUTOMATICALLY OPERATED, SMALL TEST GESes UNDER THE GENERAL LEADERSHIP OF USSR MINENERGO."

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NON-NUCLEAR POWER

CONSTRUCTION SUPPLY PROBLEMS AT TYUMEN BEREZOVSKAYA GRES

Moscow SOVETSKAYA ROSSIYA in Russian 31 Jan 86 p 1

[Article by N. Batalov: "A Sharp Signal--Powerless Schedules"]

[Text] Tyumen--The Surgut power machine builders have accumulated a great deal of experience, constructing the first power station in the oil-producing area of the Ob region. They are using this experience to the utmost by building a second station as well. The first head took 15 months to commission, the second took just over 9 months, and they have decided to introduce a third one even more quickly. And the ministry has even reduced that time frame, indicating the commissioning for as early as May. The kollektiv is not put off by the novelty. As long as there is a design and equipment, there will be people around to build!

But following the ministerial directive something inexplicable started happening: one delivery schedule appeared, then another. Each one of them carefully detailed what kind of plant was needed and when it should send its production to Surgut. Alas, it would appear, a third schedule will be published.

"To do it by May," says the brigade leader of the thermal erectors N. Lavygin, "we must now complete the foundation over the turbogenerator, but the Berezovskiy plant is not coming through on the parts delivery."

"And in other areas the site is not being equipped in the best way," adds section chief A. Nesterov.

The designs are not coming along in proper sequence from the Belgorodskiy power machine building plant and the Novosibirsk plant of its own ministry of origin. The list of debts is endless. The low pressure pipelines promised back in November are not yet here. In December, construction of high pressure pipelines should have been started--they have not arrived yet either.

The situation is becoming absurd. The Surgut power machine builders are setting records by commissioning energy blocks in such short time frames. Yet they are always told they are not working well if the scheduled date of commissioning is in danger of not being met. People have not only moral costs to bear. Beyond that, if they do not start up by May, they will also lose material compensation.

A question must be asked: who is being disciplined by these stiff timetables for commissioning of the third unit? And how did the USSR First Deputy Minister of Power and Electrification S. Sadovskiy, and after him the minister himself, A. Mayorets, intend to outfit the site in that short a time when signing delivery schedules for designs and equipment?

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DESIGN ORGANIZATIONS FAULTED FOR SLOW INTRODUCTION OF NEW BOILERS

Mowcos SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 Jan 86 p 2

[Unsigned article: "To the Highest Level"]

> [Text] "TO PROVIDE IN DESIGNS FOR WIDE APPLICATION OF PROGRESSIVE SCIENTIFIC-TECHNOLOGICAL ACHIEVEMENTS, OF RESOURCE AND ENERGY-SAVING TECHNOLOGIES AND EQUIPMENT..." (Draft of Basic Trends, Section IX).

One of the ways of carrying out this directive was suggested by participants in the discussion, F. Kushnarev, G. Rokacheb and N. Golovanov in a letter "To the Highest Level," published on 12 November of last year. They raised the matter of accelerated introduction of gas-fuel boilers with a so-called swirling-type furnace: they are economical to build--one in nine can be made of recycled metal, they make construction less expensive—they allow for efficiency of design, and are cheaper to operate due to their predictable use of fuel. The authors of the letter cite one of the reasons for the slow introduction of these boilers: managers of the systems and associations of USSR Minenergo [Ministry of Power and Electrification] which especially needs these boilers, gravitate toward the old equipment to which they are accustomed. The ministry has not yet replied.

It has now come to light that there are other factors slowing down introduction of the boilers. The deputy minister of power machine building S. CHASNYK informs the newspaper of unacceptably protracted test time for new technology. For example, the pilot model of boiler model "TPE-427" was manufactured and delivered to the Novosibirsk TETs-3 back in 1979, but the testing for it is being planned only now, in other words an entire five-year plan later. The association "Krasniy Kotelshchik" [Red Boiler-Maker] is ready to accept large volumes of orders for manufacturing boilers with the swirling-type furnace of other models, but for this year only 8 have been ordered. USSR Gosplan, at their stage of the proceedings, reviewed this matter. In conformity with their adopted recommendations Minenergomash [Ministry of Power Machine Building] on more than one occasion sent their proposals on a wider application of the boilers in power stations to power engineering specialists. However, there has been little progress. The deputy minister, S. Chasnyk, believes that the whole problem lies in the unwillingness of the design organizations of USSR Minenergo to draft standard plans for power stations containing the old boilers.

The editorial staff is waiting for managers of USSR Minenergo to reply at any rate to the substance of this matter.

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BRIEFS

KRASNOYARSK GES PLAN MET--Divnogorsk, Krasnoyarskiy kray (TASS)--The power machine specialists of the Krasnoyarsk GES have fulfilled an important point of their annual obligations on the eve of the Great October holiday. The kollektiv of the country's largest hydropower station has completed its five-year plan for generation of electrical energy. Within this period of time it has transmitted roughly 86 billion kilowatt-hours of power into the country's unified power system. By halving no-load time of the units after major repairs, the power machine specialists with that alone were able to generate an extra 50 million kilowatt-hours of electrical energy. The automatic control system introduced half-way through the five-year plan is operating very well, and is allowing for optimal scheduling of generator work time depending on the load on the whole system. Finally, almost 10 percent less water is used now to generate one kilowatt-hour of power than at the start of the five-year plan. From now until the end of the year the station will generate an extra billion kilowatt-hours of electrical energy. [Excerpts] [Moscow SELSKAYA ZHIZN in Russian 3 Nov 85 p 1] 12912/12859

STEAM TURBINE COMPLETED EARLY--Leningrad--At the "Leningrad Metal Plant" a 300,000 kilowatt capacity steam turbine with ordinal number "100" successfully completed testing. The anniversary machine, built for the Novo-Angrensk GRES in Uzbekistan, was produced ahead of schedule. The kollektiv of the steam turbine workshop is satisfying its obligation by sending off the turbine to the customer ahead of the planned schedule. [By V. Ponomarev, staff writer] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 8 Feb 86 p 1] 12912/12859

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